DIABETIC CONTROL: EQUIPMENT FOR USE WITH VISION LOSS.

AIDS AND APPLIANCES REVIEW

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Introduction
by
Donna L. Johnson

The person experiencing the condition known as diabetes mellitus soon learns that living and growing in harmony with it requires adaptation of lifestyle to meet the body's needs. It is important for the diabetic to learn to live, and grow, and enjoy life as naturally and independently as possible, yet as a conscientious diabetic. It is only by working with the body and not against it that the person can hope to achieve maximum health. To be successful, he or she must be educated about and willing to adjust to the necessary modifications now required to keep the body functioning as stably as possible. He or she needs to know about the causes, symptoms, and treatment of a very high or very low blood sugar; he or she needs to know how injected insulin, food intake, exercise, and stress affect the level of sugar in the blood in order to plan and carry out the tasks of diabetic control: monitoring glucose levels, proper food management, and corresponding insulin adjustments.

Even with conscientious attention to adapting lifestyle to the body's needs, the diabetic can experience serious long-term medical complications. Among them are cataracts, glaucoma, and diabetic retinopathy—a disease which affects the small blood vessels on the retina. For those persons experiencing legal blindness because of these eye complications, learning to continue living in harmony with their diabetes is still important. This harmony can be attained by gaining a better understaning of the condition itself and by learning to use special aids and appliances in place of eyesight: various special syringes and gauges for measuring the insulin; enlarged test tapes, charts, or audible analyzers for urine-glucose monitoring; brailled or taped diabetic diets, meal plans and cookbooks.

To assist the visually impaired diabetic in gaining this education, it is essential for the person working with him or her in rehabilitation to gain a basic knowledge of the diabetic's individual physical and psychological needs. Although diabetics share common traits, each person remains unique, with special, individual rehabilitative needs. It is imperative for the rehabilitation community to respond appropriately to these needs to make a positive difference in lives of persons with diabetes and vision loss.

Editor's Note

Diabetic control, with sight or with vision loss, is a complex procedure. Maintaining control of blood glucose levels—the central task—requires careful dedication to a routine which, to say the least, can impinge on very human desires to live spontaneously and to follow impulses—impulses to do what everyone else is doing, maybe just filling up on McDonald's french fries when the rest of the gang does it so harmlessly. But with diabetes such impulses can lead to the high levels of blood glucose characteristic of the condition—with damaging results.

Besides corralling such impulses, good diabetic control requires harnessing energy into a network of daily routines. Daily life must fit the routines of testing urine or blood for glucose as often as four times per day; measuring and injecting insulin at least once, and for some people, four times per day; and eating in accordance with an unvarying schedule of meal times and precisely planned menus. The regimen is intricate. Even with sight, handling it successfully demands a high degree of motivation, commitment, knowledge, and skill.

Ordinarily, in fact, sight is critical to the tasks of diabetic control: to test for glucose in urine or blood, a color change on a narrow reagent strip must be matched to the colors of a glucose percentage chart; the fine-line unit scale on the syringe must be read accurately to draw up the insulin dose for injection; to maintain the prescribed diet, ingredients and food portions must be measured in calibrated cups or spoons or weighed on a scale meant to be read with sight. The necessity for special, nonvisual devices and adapted techniques can become urgent with vision loss, a potential complication of diabetes. This issue of AAR aims to provide up-to-date product information about much of the available equipment designed for management of these tasks with vision loss; in addition, it includes blood glucose testing equipment, not yet adapted for use without sight. Of course, these devices must be used with knowledge of diabetes itself.

However, AAR does not pretend to make any steadfast pronouncements about diabetes or diabetic care. Within the field of diabetic care, controversy continues over such crucial topics as the best methods of insulin delivery and the role of high blood glucose levels in causing diabetic retinopathy. Few issues are settled. Given this present lack of orthodoxy, even approaching an understanding of diabetes can be a complicated undertaking with an uncertain outcome.

We would stress that no part of this issue should be taken as medical advice; we present all material about diabetic care in hope that it will provide points of departure for a continuing search for better understanding of diabetes and its control. Some, or much, of this material may differ from the clinical practices of some established medical centers—since variance in approach is a fact of diabetic care. And approaches and techniques described in this issue may well differ from the prevailing habits of blind diabetics embarking on a course of learning therapeutic techniques anew with vision loss. Recognizing such conflicts, we present all material on diabetic care per se advisedly. We offer it to those in the field of blindness rehabilitation who would begin to learn about diabetes and diabetes care as a necessary context for evaluating the devices and techniques which may be useful to the blind diabetic in the rehabilitation setting: aids for insulin administration, for blood and urine monitoring, for diet and exercise management.

To provide the background for the articles on aids, Issue No. 6 of AAR begins with an explanation of the condition and a brief history of insulin therapy.

Robert McGillivray
Marlene Gast

INSULIN THERAPY

Diabetes: Some Physiological Considerations for the Blind Person

by
Richard M. Connors, M.Ed.

The existence of numerous "Fifty Year" diabetics testifies to the fact that diabetes can be controlled; essentially normal lives can be lived with it.[1] For this to be so, however, the condition must be understood, faced for what it is, and dealt with. It is the goal, hopefully, of those of us involved in the rehabilitation of the blind diabetic to help him develop a state of health and continued expectation of health in which he himself will be the prime participant.

Advances in our understanding of the disease and important technological advances like home blood glucose monitoring have at last made this ideal possible.

Diabetes is not an easy disease to understand. The variety and complexity of books currently available on the subject amply demonstrate that. Many of these books are very good and treat the mechanics of control in great depth. This brief article does not seek to take their place. Rather we will try here to draw the reader's attention to some simple facts and illustrations which may contribute something to an overall understanding of the disease and give a framework for the material to follow.

Diabetes is defined as the state caused by insufficient available insulin.[2] Long ago it was noticed that there are two major forms of the disease. Various terms have been applied to these forms over the years: juvenile-onset and adult-onset; Type I and Type II; insulin dependent and non-insulin dependent. The latter terms are the ones in current use and reflect the present understanding of the condition. Insulin-dependent diabetes *tends* to have its onset among juveniles (hence the original term for it), but is now being called insulin dependent because that appears to be the salient characteristic: control cannot be achieved without daily injections of insulin. Non-insulin dependent diabetes, on the other hand, responds well to weight loss, diet, exercise, and oral medications. Since insulin-dependent diabetes is overwhelmingly the form we deal with among the blind, this article will confine itself to the insulin dependent form.

Insulin is a hormone produced in the pancreas. It must be present in order for sugar circulating in the blood to pass through the walls of the blood vessels and reach the body tissues. Since sugar is the body's fuel or energy supply, the breakdown in sugar metabolism which occurs in diabetes is life-threatening unless corrected.

The body is a self-regulating system, with constant back-and-forth communication going on among the various parts of the system. Normally, sugar and insulin exist in harmonious balance. When a low level of sugar exists in the body's tissues, the perception of a need for food arises. Appetite is stimulated; we feel hungry; we eat. As we do, the resulting rise in blood sugar stimulates the release of insulin. Interaction of insulin and blood sugar allows the sugar's passage into the tissues. Hunger is slaked; eating stops; excess sugar is transformed into fatty substances for storage. Insulin release gradually shuts down; the system returns to static equilibrium. This interaction between sugar and insulin can be roughly diagrammed as follows:

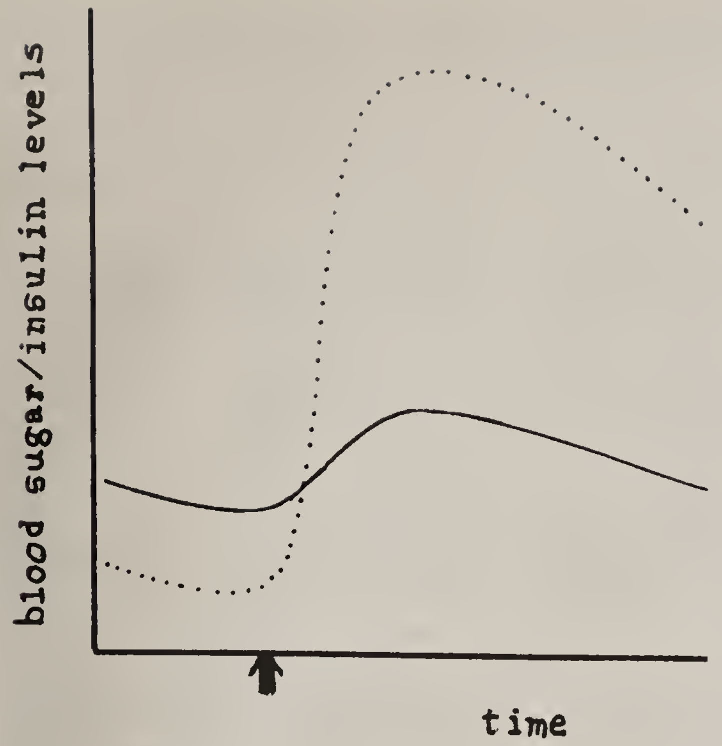


Figure 1 Insulin/blood sugar variations in a non-diabetic at meal time. Note the very great variation in insulin level.

—— blood sugar
.... pancreatic insulin
🠅 food intake

In diabetes the blood sugar/insulin mechanism is impaired, and MAXIMUM POSSIBLE release of insulin is still not enough. Sugar stays in the blood rather than moving from there into the tissues where it is needed. It accumulates, sometimes to enormously high levels. Figure 2 diagrams this situation, and shows an insufficient supply of pancreatic insulin, as do all subsequent illustrations in this article. Insufficient SUPPLY of insulin, however, is not always the problem (see note 3).

The very high level of blood sugar shown in Fig. 2 means that sugar which should be reaching the body tissues is not. Tissues which thus remain essentially unfed continue to create a state of hunger. The person goes on eating, therefore, well beyond the point where he would normally stop. This is the condition called "polyphagia," or excessive eating, and it represents a state where the body is quite literally starving in the midst of plenty.

If this condition of starvation despite eating goes on for long, the person may eventually lose consciousness, entering the state called "diabetic coma." In coma the body is metabolizing its fat reserves very quickly in a desperate attempt to feed itself. Fat, however, does not metabolize cleanly; byproducts called ketones are created and these, as they accumulate, act like strong poisons. They may eventually cause loss of consciousness; if the person remains untreated, death is a possibility.

The opposite condition from diabetic coma, insulin reaction, or hypoglycemia, may also cause a loss of consciousness. Where diabetic coma follows upon a state of abnormally HIGH blood sugar, insulin reaction, however, follows upon too LOW a level of blood sugar. Insuln reaction can result from a variety of factors, including not eating enough food to "balance" the injected insulin, a sudden surge of unusual physical activity, or taking too much insulin by mistake. Although loss of consciousness can take place with insulin reaction, it is seldom a life-threatening crisis, and ample opportunity generally exists for the person to treat the reaction with sugar-containing food. That is all that's necessry—eating something with quick-acting sugar in it. Orange juice is excellent.

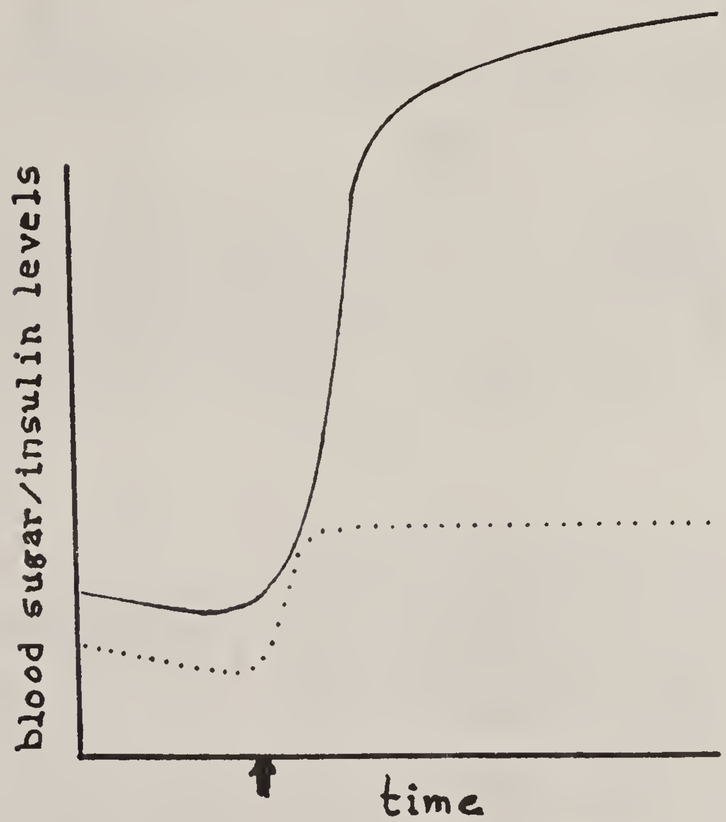


Figure 2 Insulin/blood sugar levels in an uncontrolled diabetic. Note that as blood sugar begins to rise with food intake, so does insulin. Insulin rise, however, stops far short of the level needed, and blood sugar continues to rise to a much higher than normal level.

—— blood sugar
.... pancreatic insulin
🠅 food intake

Fig. 3 shows a possible course of blood sugar variations over an entire day in the case of an uncontrolled diabetic. Note that every time food is eaten (arrows) blood sugar simply goes higher, and afterwards falls only very sluggishly. As long as SOME pancreatic insulin is available so that body tissues obtain SOME of their needed sugar, coma will generally not occur despite what may be extremely high blood sugar.

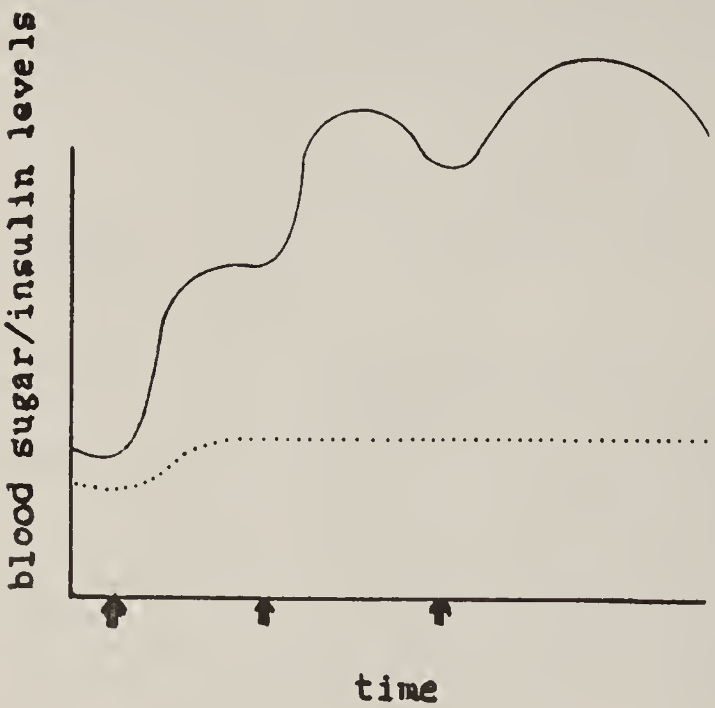


Figure 3 Possible blood sugar variations in an uncontrolled insulin-dependent diabetic. Note that an impaired pancreatic output is assumed here: food intake (arrows) has no effect on insulin supply, and blood sugars simply increase every time food is eaten.

—— blood sugar
.... pancreatic insulin
▲ food intake

When insulin first became available in the 20s, there was only one form of it: what we now know as "regular." This fast-acting, short-duration insulin, essentially the same as the insulin released by the body's own pancreas, needed to be injected three or four times per day to achieve control. While this kept alive many people who would otherwise have died, and while diabetics could then begin to live essentially normal lives, many did not welcome the need to inject themselves several times a day. Beginning in the mid 30s, therefore, a succession of time-release insulins came onto the market attempting to address this problem. PZI, NPH, lente, and other slower-acting insulin seemingly solved a major problem for many diabetics by making it possible for them to inject only one daily dose, instead of four. Eventually many new types of insulin found their way to the market and enabled physicians to pick whatever type seemed best for individual patients. Table I summarizes the types commonly available at present.

TABLE I: Types of insulin currently available with their characteristics of action.

TYPE & APPEARANCE	*ONSET*	*PEAK*	*DURATION*
Fast-acting			
Regular (clear)	½ hr.	2-4 hr.	6-8 hr.
Semilente (cloudy)	1½ hr.	4-7 hr.	12-16 hr.
Intermediate			
Globin (clear)	2 hr.	10-14 hr.	14-22 hr.
NPH (cloudy)	1 hr.	10-16 hr.	18-30 hr.
Lente (cloudy)	1 hr.	10-16 hr.	18-30 hr.
Slow-acting			
Protamine Zinc/PZI (cloudy)	6 hr.	14-24 hr.	24-36 hr.
Ultralente (milky)	5 hr.	20-26 hr.	36+ hr.

There seems to have been a widespread impression from about the mid-30s until quite recently that these time-release insulins had solved the diabetic's problem for all intents and purposes. This impression apparently grew stronger when oral medications became available in the 50s. Suddenly many people could get by without shots at all. Evidence was slowly accumulating, however, that all was not well with this "single-dose" insulin therapy. Distressing numbers of diabetics were experiencing one or more of the complications of the disease: nerve, kidney, and eye damage. Those who believed that very strict control of blood sugar could help avoid these complications gradually won their case. A major factor in the development of complications was eventually recognized to be chronically high blood sugars. And to some extent the long-acting insulins were responsible. Consider Fig. 4.

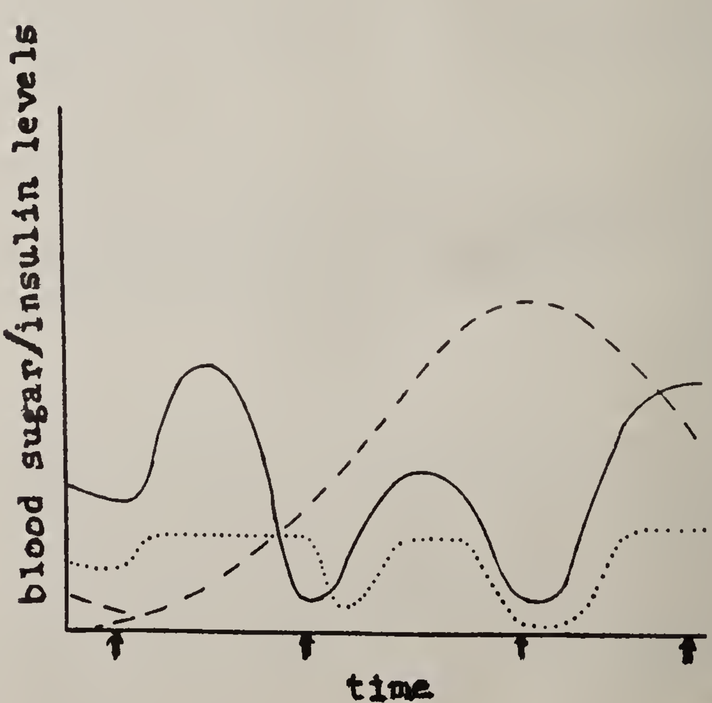


Figure 4 Effect of a single morning dose of long-acting (e.g., NPH) insulin on blood sugar in an insulin-dependent diabetic. Note the sharp rises in blood sugar in the morning (first arrow, breakfast) and evening (third arrow, supper; fourth arrow, bedtime snack).

—— blood sugar
.... pancreatic insulin
– – NPH insulin
▲ food intake

In this illustration blood sugar is shown by the solid line and the impaired pancreatic insulin output by the dotted line as before. Injected time-release insulin (e.g., NPH) is shown by the dashed line. Note that even though the injection is taken before eating breakfast (the first arrow on the left), it does not begin acting to any significant extent until considerably later. After breakfast, therefore, blood sugar shoots up and doesn't fall until late in the morning. When it falls, it plunges, then stays reasonably low as it works efficiently with lunch (the second arrow). Supper—the third arrow—is generally eaten at a time when the injected insulin has begun to decline in activity. Since, in this country, supper tends to be the biggest meal of the day and to contain large amounts of protein and fat, this presents problems. The digestion of what tends to be a typical American supper will not be complete until after the injected insulin is nearly all used up. Digestion goes on, however, and blood sugar builds up. Adding to the problem still further is another American habit of nighttime snacking (the fourth arrow). Thus is is probably not at all uncommon for many diabetics to spend all night and a good part of the next morning with high blood sugars. And this despite frequent insulin reactions in the late morning and afternoon which incline them to think they're well controlled!! One physician has called this single-dose therapy, which was popular for decades, "... the worst thing that ever could have happened to diabetes... many juvenile diabetics who were on long-acting insulin for twenty years or more are now blind, sick, and dying."[4]

While single-dose therapy apparently is perfectly appropriate for some diabetics, apparently, for others it is a thing of the past. The original regimen from the 1920s of many daily injections of regular insulin has now, in effect, returned with the advent of the insulin pump. While its use is not yet widespread at this writing, it shows promise that it soon will be. The pump delivers its insulin not in a small number of large doses the way separate injections do, but in a large number of small doses, more like the way the pancreas functions. For many insulin dependent diabetics, the therapy that appears to best meet their needs is a multiple-dose regimen of mixed insulins. A typical daily routine of this type might involve a morning dose of, for example, NPH and Regular, and an evening dose of the same insulins in different amounts. The effects that can be achieved with this sort of therapy are shown in Fig. 5.

Here, the morning and late evening rises in blood sugar diagrammed in the previous figure are smoothed out by doses of regular insulin (dash/dotted line), with the longer-acting NPH dose (dashed line) taking care of the midday blood sugar. Blood sugar resulting from this therapy (solid line) shows gradual up and down waves staying more or less within normal limits. At any given moment the amount of insulin available for work is the SUM of the fractional doses of pancreatic, NPH and regular.

The problems facing the visually impaired diabetic, then, are how to measure accurately these often-complex doses of insulin, and how to monitor blood sugar levels. Technological advances, some very recent, have finally brought these problems within reach of a solution.

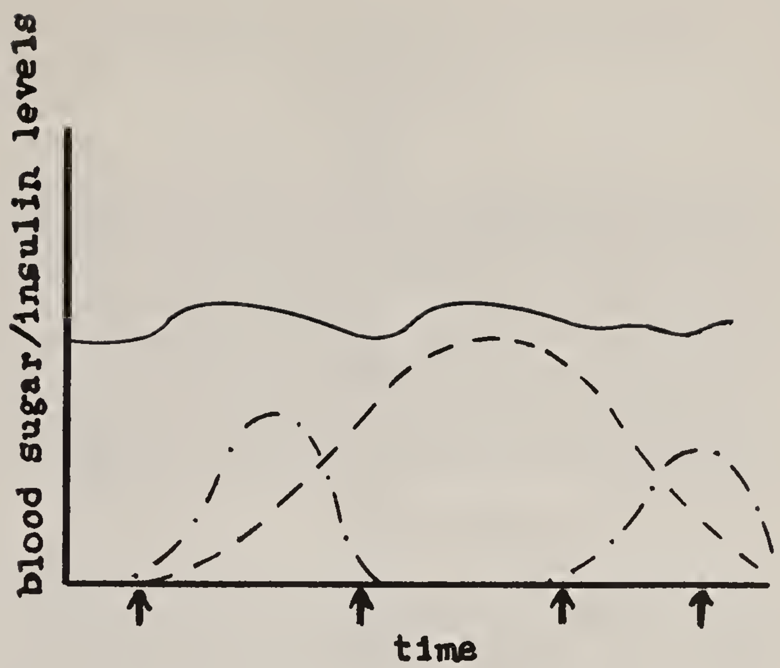


Figure 5 Example of multiple-dose therapy. Body's own pancreatic insulin is not shown for the sake of clarity. The doses of regular insulin before breakfast and again before supper fill in the gaps left by the NPH.

NOTES

[1]Cochran, H.A., Jr.; Marble, A.; Galloway, J.A. "Factors in the Survival of Patients with Insulin Requiring Diabetes for 50 Years," *Diabetes Care*, Vol. 2, No. 4, pp. 363-8, July-August, 1979.

[2]Krall, Leo. *Joslin Diabetes Manual*, Eleventh Edition. Philadelphia: Lea & Febiger, 1978, p. 5.

[3]In some cases the diabetic is observed to have a normal, or even above normal, supply of insulin. The problem appears to be that the body cannot use some of the insulin present in the blood. The reason for this is not fully understood.

[4]Goodman, Joseph. *Diabetes Without Fear*. New York: Avon, 1978. p. 28.

Basic Equipment for Insulin Administration

by

Ruth B. Carr, R.N.

In managing insulin administration, insulin and insulin syringes have served as basic equipment since 1922 when insulin, isolated from the pancreases of cattle or pigs, was first injected into humans for the treatment of diabetes mellitus. Even with recent developments in insulin delivery, such as the insulin pump, syringes and vials of pork or beef insulin remain the basic equipment. Much of the following discussion will prove familiar to those already acquainted with this basic equipment. However, it also contains a brief description of the "new insulins" which may bring to light some of the implications for their use in insulin administration with vision loss.

Commercial insulin is contained in a glass vial, permanently affixed with an aluminum cap, which is in turn centered by a tiny rubber diaphragm. The rubber diaphragm permits penetration by the hypodermic needle of the insulin syringe so that the insulin may be withdrawn and measured for injection. Insulin vials may have different shapes, but all insulin vials have the same spatial volume—10 cubic centimeters; they also contain the same volume of liquid—10 milliliters. For example, the Danish insulin Novo is sold in a tall, narrow vial in both Europe and the United States while American insulins (Lilly and Squibb) come in relatively squat vials; yet these vials all contain 10 milliliters of liquid in 10 cubic centimeters of space.

Even though all commercial insulin vials contain the same amount of liquid, concentrations of insulin within the total liquid vary. The insulin vial does not contain pure insulin but rather a portion of pure insulin, measured in "units," combined with other compounds in liquid form. Variations in concentration result from the fact that the amount of pure insulin combined with the other liquid in the vial can be increased or decreased compared to that other liquid. Therefore, all insulin vials are not only labeled to show the form of insulin contained (Regular, Semilente, Globin, NPH, Lente, PZI, or Ultralente); they are also labeled to indicate which of the three commercially available concentrations of insulin is contained.

Presently, the concentrations of insulin on the market are U-40, U-80, and U-100. The terms refer to the number of units of insulin incorporated in each milliliter of liquid: U-40 contains 40 units of insulin incorporated into each milliliter of total liquid in the vial; U-80 contains 80 units per milliliter; U-100, 100 units per milliliter. Clearly, the amount of insulin compared to the amount of liquid in which the insulin is mixed is greatest in a vial labeled U-100; in other words, U-100 insulin is the strongest commercially available insulin. In the near future, the only strength of commercially available insulin will be U-100; already U-80 insulin has been phased out.

The single available insulin strength should prove fortunate, since the availability of three different concentrations has been known to contribute to dosage error. Even though dosage error from this source may soon be a thing of the past, an explanation of it seems warranted since the problem could persist during the transition to the uniform concentration of U-100 insulin.

In order to understand the problem it is first necessary to know that each of the three concentrations has its own syringe, specially calibrated for that concentration only. To administer an accurate dose of insulin, *only* a U-100 syringe can be used with U-100 insulin; *only* a U-40 syringe can be used with U-40 insulin; and *only* a U-80 syringe was to be used with U-80 insulin. (As an alert, the different syringes are not only *labeled* according to concentration but also *color-coded:* a U-40 syringe is marked in red, U-80 in green, and U-100 in black.)

For an illustration of how dosage error can occur with the availability of various concentrations, consider how the standard 1 cubic centimeter syringe would be differently calibrated for U-100 insulin and for U-40 insulin. The figure below shows that the mark for a 20 unit dose of insulin is at the half-way point on the U-40 syringe, while on the U-100 syringe, the 20 unit mark is at a point 1/5 the total volume of the 1 cc syringe.

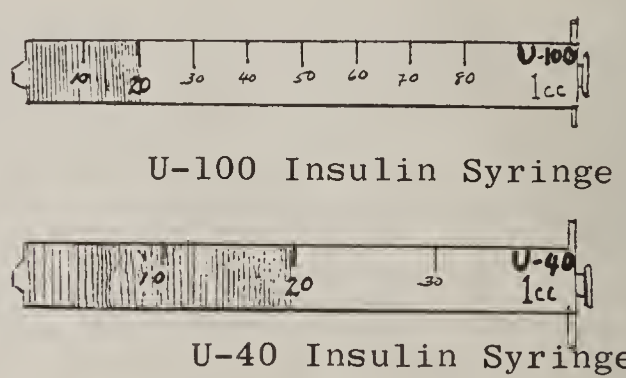


Figure 1

The relationship may be explained as follows: full, a 1 cc syringe of U-100 insulin would contain 100 units of insulin; to administer 20 units of insulin, then, the 1 cc syringe would be 1/5 full since 20 in 1/5 of 100. A 1 cc syringe full of U-40 insulin would contain only 40 units of insulin; thus a 20 unit dose of insulin using the U-40 concentration in a 1 cc syringe would be exactly 1/2 cc, making the syringe half-filled exactly. Now consider the possibilities of dosage error by mistakenly using a U-40 syringe to draw up U-100 insulin for an intended 20 unit dose. The 20 unit line on a 1 cc U-40 syringe would mark the halfway point, 1/2 cc; but 1/2 cc of U-100 insulin would be a dose of 50 units of insulin, more than half the intended dose of 20 units. Consequences of such a dosage errror are potentially serious. The need for using only the U-40 syringe with U-40 insulin and the U-100 syringe with U-100 insulin is obvious. Obvious as well is the point that uniformity of concentration will greatly reduce the possibility of these large dosage errors.

Other recent changes in insulin are worthy of note.
In 1980, drug companies introduced what has been called "the new insulin." Processed beef or pork insulin (as is the "old insulin"), this new highly purified insulin contains significantly fewer impurities, considered by many physicians to cause side effects in the diabetic, including allergic reactions—a hive-like rash at the injection site; insulin atropy—loss of fat at areas of injection resulting in indentations or hollows; and immunologic insulin resistances—a rare condition almost always due to insulin antibodies. It is hoped that the use of purer insulin will contribute to decreasing these specific complications and to decreasing the incidence of diseases of the eye and kidneys which people with diabetes can develop. It is hoped that a similar contribution will be made by a synthesized insulin with an amino acid chain identical to that of human insulin; it is still in research.

These potential benefits of the "new insulin" stem partly from the fact that highly purified insulin is absorbed more rapidly and in some cases more thoroughly. The new insulins can thus prove more effective in lowering blood glucose levels; one result of using these products can be a decrease in the insulin dose required for glycemic control. But there are also potential hazards. It should be noted that any dosage error on the side of an unintended increase could have more pronounced capacity to send blood sugar levels too low, since both the more purified insulins and U-100 insulin are in effect stronger. For these insulins the exactness of measurement is at least somewhat critical. This caution is offered to point out the need for the diabetic with vision loss to have accurate devices and reliable techniques for measuring the insulin dose.

The availability of a new insulin product with the trade name Mixtard has been reported recently; it is on the shelf in larger, urban pharmacies. The insulin is composed of a stable mixture of 30% rapid-acting insulin and 70% intermediate-acting insulin. This premixed combination has potential use for those whose daily insulin injection consists of a so-called mixed dose. (Refer to "Diabetes: Some Physiological Considerations for the Blind Person," page 5.) Since measuring a mixed dose is more complicated than drawing up a single insulin, and since the procedure is further complicated by vision loss, it is possible that this product could prove useful. However, there have been cautionary comments by health professionals, who point out that this product would not permit the effects of the insulin dose to be monitored in respect of its specific components nor to be adjusted specifically for any changes in health or exercise. Yet those who believe they might benefit from this product should consult their physician. (The product is distributed by Nordisk USA; 7315 Wisconsin Avenue, Suite 851-W; Bethesda, MD 20014.)

Of course, for any contemplated change in insulin, the physician should be consulted. Insulin may be purchased from the pharmacy without a prescription; however, the basic form and daily dose(s) of insulin are originally determined and thereafter monitored by the physician.

In contrast to insulin, which is a nonprescription drug, the other basic equipment of insulin administration, insulin syringes, must be prescribed by the physician. The prescription specifies the type of insulin syringe which the person may purchase at the pharmacy. Generally, the insulin syringe consists of a sharp, hollow needle, through which insulin is both withdrawn from the vial to fill the syringe barrel and then injected into the body; the barrel, marked and calibrated for units of insulin; the plunger, which ends in a disk. The disk at the end of the plunger becomes an important component in measuring insulin without sight; it is referred to in Fig. 2 (and throughout this issue) as the plunger base.

Figure 2

Before the introduction of plastic, disposable syringes, the basic device of insulin administration was the insulin syringe made of glass. But the glass syringes have several disadvantages. In glass syringes with removable needles, the hub, which holds the needle, creates so-called "dead-space"; here, up to 10 units of insulin may be hidden so that use of such syringes can result in dosage error. Other disadvantages include possible breakage, required sterilization with each use, and the eventual wearing away of the scale. Along with no possibility of dosage error from hidden insulin in the hub, plastic disposable syringes have other advantages: their fine-gauge needles are ultra-sharp for easy, comfortable insulin injection; they are pre-sterilized; and since they may be purchased in money-saving packs of quantities such as 10 or 100, they are economical. For these reasons, plastic disposable needles, for the majority of users, have replaced the glass insulin syringe.

Some gauges for measuring insulin without vision are designed for use with only certain brands and sizes of syringes. Thus it could be useful to know that for U-100 insulin there are two sizes of plastic disposable U-100 syringes and two sizes of reusable glass syringes. The two major manufacturers of insulin syringes, Becton-Dickinson and Monoject, each market a 1-cc disposable syringe and a .50-cc disposable plastic syringe; these syringes and their use with gauges for insulin measurement without vision are discussed in detail in "Measurement and Injection of Insulin by Blind or Visually Impaired Diabetics." Glass syringes also come in long and low dose sizes: 1-cc and .35-cc reusable syringes.

A final, useful product innovation requires mention: individually packaged alcohol wipes, for sterilizing the injection site, can replace the less convenient bottle of alcohol accompanied by cotton balls. In the East, Becton-Dickinson is a popular brand. Boxes contain 100 prepackaged alcohol wipes; price per box is currently less than $2.50.

This cursory description of the basic equipment used in insulin injection—forms of insulin and syringes—can, it is hoped, serve as background for the more particular explanations of "Devices for Insulin Administration with Vision Loss."

Insulin Gauges: Two Views

The two articles following present opposing perspectives on the evaluation and selection of insulin gauges. "Measuring and Injecting Insulin: Equipment and Techniques for Use by Blind or Visually Impaired Diabetics," by Joyce Schulz, R.N., advocates the exclusive use of the Insulgage, which is commercially manufactured; the article discusses reasons for choosing this device over all others. The article not only details the advantages of the Insulgage, it outlines the disadvantages of homemade devices.

The second article, "Modifications on Insulin Techniques for the Visually Impaired or Blind Diabetic," by Alice Raftary, M.Ed., develops the argument on behalf of the homemade insulin gauge. In addition, instructions are provided for fabricating one from common, household materials, and suggestions for teaching the use of any device are given.

Though the two articles are opposed, both present equally valuable information, information which, we feel, can be useful regardless of one's agreement or lack of agreement with the overall point of view of either article. Our intention is *not* to encourage the reader to choose one approach over another. Rather, we juxtapose the articles in hope that their strong contrast will serve to highlight the kind and range of criteria used in evaluating and selecting insulin gauges for individual use.

Measuring and Injecting Insulin: Equipment and Techniques for Use by Blind or Visually Impaired Diabetics

by

Joyce Schulz, R.N.

Technique for Labeling Insulin

With vision loss, locating and identifying vials become problems for the diabetic; knowing the amount of insulin contained in the vial as successive doses are withdrawn becomes equally difficult.

A system for labeling insulin vials is needed if the individual is taking a mixed dose of insulin, i.e., a short-acting insulin such as Regular or Semi-Lente. The simplest and easiest way of identifying the specific type of insulin is to stretch a rubber band around the longer-lasting vial. Another method used by some is to braille an R on tape and tape it to the Regular insulin vial. A variety of methods of marking can be used; but whatever method is chosen, it should make sense to the person and should be consistent. For instance, the longer-lasting insulin should not be labeled one time, then the shorter-acting insulin the next time.

To determine when an insulin vial is empty, the visually impaired diabetic must first of all determine the number of safe doses available in a vial and then have a system for keeping a record of the number of doses injected. A standard vial has 10 cc of insulin solution—whatever the type, strength, or brand. If U-100 insulin is being used, this would therefore equal 1000 units of insulin. For safety's sake, it is best to allow approximately 60 units of insulin to remain in the vial or 0.6 cc of solution. This will insure that the tip of the needle will always be in some solution. Without the amount of remaining insulin solution, the tip of the needle can protrude into air within the vial when it is inverted for withdrawing the insulin. The individual should therefore assume that a new vial of U-100 insulin has only 9.4 cc of safely usable insulin or 940 units. To determine the number of safe doses in the vial, the person must divide 940 by his dosage. For example, if a person's dose is 30 units, he or she can count on 31 safe doses since 31 is the result of dividing 940 units by 30—the number of units of each individual dose. When the number of safe doses has been withdrawn, the vial can be discarded or set aside until such time as a sighted person is available to withdraw the remaining insulin and insert it into a new vial.

A system to record accurately the number of doses administered is also a necessity. The particular system used is not as important in itself as the necessity that whatever system is used make sense to the person. One system is to count out the number of syringes equal to the number of safe doses in the vial. When the syringes are used up, the vial of insulin would also be finished. Small-sized counters are another system that some people find convenient. For example, a number of marbles, buttons, or toothpicks equal to the number of doses can be placed in a container; when each dose is administered, one object is taken from the container so that the empty container will signify that all safe doses have been used. Likewise, straight pins or safety pins in a number equal to the safe doses may be first stuck into a strip of cloth and then removed, one for each dose administered. Or pills or vitamins can be counted out, one for each dose, and swallowed before each shot; for those who take these medications daily, this system works well. Some visually impaired and blind diabetics prefer to keep a daily written or braille record of their insulin status and find this means most accurate.

Sterilizing Equipment and Inserting Needle into Vial

The widespread use of disposable needles and syringes has done away with the need for sterilizing equipment and such techniques as soaking syringes in alcohol and boiling needles. Yet for the visually impaired diabetic, inserting the needle directly into the insulin vial rubber stopper without contaminating the needle remains a problem of insulin administration. Contamination usually occurs by hitting the metal ring surrounding the rubber stopper with the needle. For many years a metal funnel-shaped needle guide was the only device available to help direct the needle into the rubber stopper. However, many people can still encounter problems with the needle hitting the side of the needle guide; if the needle guide is not itself sterile, the needle can become contaminated.

The Holdease Needle Guide and Syringe/Vial Holder, manufactured by Meditec, Inc., is a device available for solving this problem. The insulin vial snaps in one end, and the insulin syringe in the other so that the syringe needle slides directly into the insulin vial through the rubber stopper. There is no other material in its path to cause contamination.

Drawing and Measuring Insulin

Over the past several years a variety of devices to assist in self-measurement of insulin has been marketed; these devices vary with respect to safety and accuracy. Before determining which aid to select, some consideration needs to be given to the suitability of using disposable insulin syringes with any kind of volume regulator or precalibrated loading device.

There are various brands of disposable syringes—the three major brands being B-D, Monoject, and Jelco. Each of these manufacturers makes insulin syringes in several types—long, short, attached needle, lo-dose, etc. Each brand/type is different in its exact shape and dimensions.

During production the syringe manufacturers have careful control only over certain syringe dimensions such as the barrel of the syringe. A consistent dimension to each barrel of the syringe is necessary for accuracy when it is filled visually in the traditional method. Other parts of the syringe, specifically the plunger, play no part in the accuracy of the dosage measured and withdrawn using sight. These are of no concern to the manufacturers and are not necessarily checked. However, when a volume regulator such as Dos-Aid or pre-calibrated loading device such as the Insulgage loading gauge is used to measure insulin, the length of the plunger becomes equally important for an accurate dosage. It should be understood that only those brand/types of disposable syringes whose production characteristics are such that maximum variations of those parts affecting accuracy are sufficiently small should be selected for use with pre-calibrated or volume-regulating devices.

According to information from the manufacturer, the Monoject long 501 syringe is definitely not suitable and should not be used with any type of device.

Varying dimensions for the syringe plungers of different manufacturers can also make for hazards with homemade gadgets and devices commercially available. One of the generally unrecognized hazards with homemade gadgets and many of the volume regulators on the market is the capability of using various disposable syringes in the same device. Medication errors can result if the regulator has been pre-set or pre-cut for one brand/type of syringe and another brand/type of syringe is used. This can happen frequently because of special sales on syringes. The person can change his or her brand of syringe for economic reasons alone without foreseeing other consequences. Unless the person has been instructed and cautioned about the variances in brand/types of syringes, he or she may unknowingly measure up an amount of insulin with a device that has been pre-set to measure the specific dosage with another brand/ type of syringe.

When selecting a particular device to aid in self-measurement of insulin, the essential aspects to consider are:

i. Is it safe? Is it possible to interchange various brand/types of syringes in it?

ii. Is it accurate?

iii. Can it be read by the visually impaired or blind diabetic so that he/she is not tied in to a sighted person for pre-setting the device each time his/her dosage is altered?

iv. Can a mixed dose be safely and accurately measured?

v. Is it simple and compact?

The one device on the market at the present time that meets all these needs is the Insulgage loading gauge manufactured by Meditec, Inc., Englewood, Colorado. My experience suggests that the Insulgage loading gauge in combination with the Holdease Needle Guide and Syringe/Vial Holder provides the visually impaired or blind diabetic with a safe, accurate means of measuring his or her insulin.

When actually drawing and measuring insulin, a concern many visually impaired diabetics and some professionals have is the possibility of drawing and injecting a large amount of air instead of insulin. Consistent use of proper techniques for filling the syringes assures safety in this area. There is also less chance of large bubbles being drawn up by using disposable syringes with attached needles. This is because of reduction of dead air since the hub of the needle has been eliminated. Reassurance should also be given that a large air bubble injected sub-cutaneously will not cause any damage, the only concern being that a large bubble of air will replace units of insulin, producing a medication error. A small pinpoint bubble of air is of no concern.

Specific instructions for drawing and measuring insulin with use of the Insulgage loading gauge and Holdease are as follows:

Dose of Single Insulin

(1) Rotate insulin vial between palms of hands to mix insulin.

(2) Wipe rubber stopper of insulin vial with alcohol wipe.

(3) Insert vial into Holdease—snap vial into large opening and slide inward until metal cap is against center divider.

(4) Insert syringe in Holdease—grip syringe near needle end, twist off needle guard and press syringe into clip through top opening.

(5) Pressurize vial—to correctly pressurize vial an amount of air equal to the insulin dose needs to be injected into the vial before solution is withdrawn. To achieve this, hold the gauge so that the slotted end is down. Place the slot in the gauge over the head of the plunger. Pull down with the gauge to withdraw the plunger, while pressing it lightly against the syringe. Remove gauge. Slide syringe lightly toward vial until stopped. Position holder with vial down and insert air into vial.

(6) Fill syringe—turn holder to upright position with vial on top. Grip syringe any comfortable way and pull plunger back about one finger's width—then push insulin back into vial. Repeat this procedure two more times—this is done to clear bubbles. With plunger pushed all the way in again, place the slot in the gauge over the head of the plunger. Pull down with the gauge to withdraw the plunger while pressing it lightly against the syringe. Pull the plunger out until the gauge fits between the plunger head and the end of the syringe. You can feel the gauge slipping in to fit over the disk plunger base. Then pull the plunger out a bit more—about 2 or 3 units. Now push the plunger in with the gauge as far as it will go. Note: In this final correctly loaded position, the disk of the plunger base should be firmly against the back of the slot in the gauge.

(7) Slip the gauge off the syringe. Slide syringe in clip until needle is completely out of vial. Turn needle end up to lift syringe out of clip.

Mixed Dose of Two Insulins

Two gauges are needed: see step (4) below.

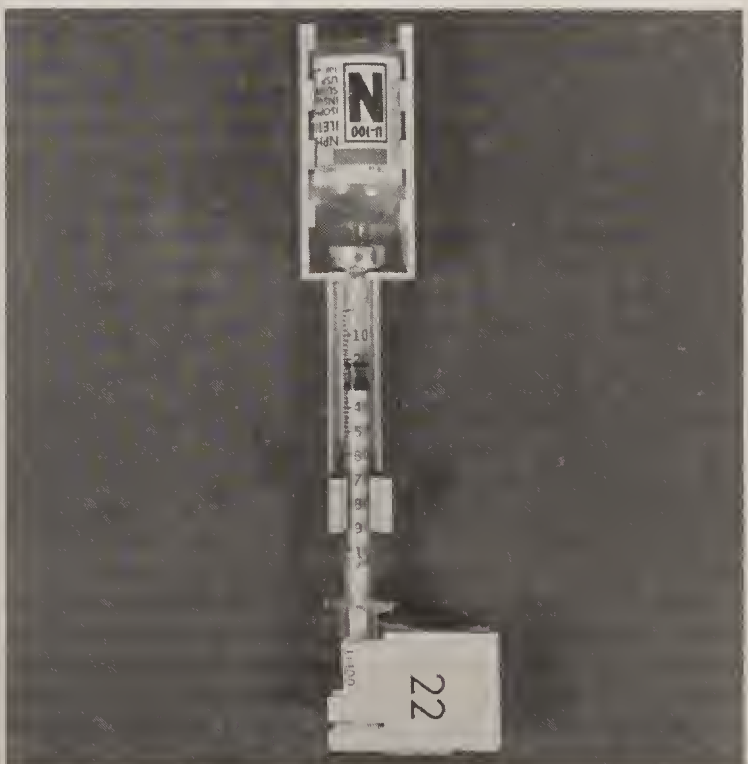
(1) Pressurize vial of longer-acting type of insulin. Follow steps 1 through 3 for *Dose of Single Insulin* above; then slide needle out of vial without removing syringe. Slide vial of insulin out of holder.

(2) Fill syringe with shorter-acting type of insulin. Insert vial of shorter-acting insulin, pressurize it (step 5) and fill syringe (step 6).

(3) Change insulin vials in holder. Slide needle out of vial but leave syringe in clip. Slide out vial of short-acting insulin and insert (pressurized) vial of longer-acting insulin.

(4) Fill syringe with second type of insulin. Slide needle into vial and fill to prescribed total dosage (step 6). Note: The size of Insulgage used for the longer-acting insulin should be equal to the total insulin dosage since it will be added to the short-acting insulin already in the syringe, e.g., 4 units Regular insulin plus 16 units NPH insulin = 4 unit Regular gauge plus 20 unit gauge for NPH insulin.

(5) Remove syringe.



Injecting the Insulin

Insulin injection techniques are the same for the visually impaired diabetic as they are for the sighted diabetic with two exceptions. When injecting insulin, the person should stabilize the hand holding the syringe by placing the little finger against the skin as a point of reference and inserting the needle at the skin surface. This differs from the sighted technique of inserting the needle with a jab like throwing a dart.

After inserting the needle it is not necessary to pull back on the plunger to check for blood. Reassurance may be needed that this in no way endangers the person. This may be a step that the person has previously been taught is essential. When using proper technique and insulin injection sites, the probability of injecting into a blood vessel is remote. If this should occur, the only result would be a quicker absorption of the insulin.

Injection Technique:

(1) Wipe off the injection site with alcohol wipe.

(2) Pinch up the area where the needle will be inserted between thumb and fingers of free hand. Pinching up the area will pull the fat away from the muscle and the injection will then be into the fat. To pinch up the area on the arm, press the back of the upper arm against a chair back or corner of wall. Roll the arm down.

(3) Insert the needle as instructed above.

(4) The skin may also be spread between the fingers and needle inserted straight up and down in areas where there is more fat.

(5) Let go of the area and push in plunger.

(6) Place the alcohol wipe over the needle and pull needle out. Press wipe over the area for a few seconds.

Locating and Rotating Sites for Injection

Insulin may be injected in any area that has a thick layer of fat and is free from large blood vessels and nerve. Areas that may be safely used are the upper arms, thighs, buttocks, and abdomen. To locate the areas that are safe for injection of insulin, the following procedures may be used by the visually impaired diabetic.

To locate the injection site on the upper arm, place the heel of the right hand where the left arm joins the shoulder. With the right hand thus anchored, extend the middle finger to draw an imaginary line across the top of the upper arm. Then place the right hand, heel down, on the left elbow, extend the middle finger, and draw an imaginary line across the left upper arm with the right middle finger. The middle and outer area of the upper arm between these two imaginary lines may serve as an injection site. To use the right upper arm, reverse left and right in the foregoing instructions.

To locate the injection site on the thigh, place the left hand, heel down, on the left hip bone and draw a line below the point where the middle finger rests. Then place the left hand at the bottom of the thigh with the middle finger just touching the knee cap; use the fingers of the right hand to draw a line across the thigh where the heel of the left hand rests. Use the middle and outer area of the thigh between the two imaginary lines for insulin injection. To use the right thigh, reverse left and right in the foregoing instructions.

To locate injection sites on the abdomen, place the heels of the hands on the lower ribs and draw a line using the middle fingers. Place hands on hip bones and draw a similar line. Use the area between these two imaginary lines as far as you can pinch up fat. Do not use the belt line or a one-inch area around the navel. If there is enough fat to pinch up, the buttocks may also be used.

It is important to rotate or alternate these injection sites from dose to dose, day to day. If one site is used repeatedly without days intervening between injections, then the fatty tissue will change in ways that can interfere with absorption of the insulin. On the other hand, if a completely unused site is suddenly used, then the insulin may be absorbed too well, too quickly, causing insulin reaction. Site rotation is important in the prevention of both these problems.

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Modifications on Insulin Techniques for the Visually Impaired or Blind Diabetic

by

Alice Raftary, M.Ed.

A simple, homemade volume regulator for measuring insulin can be constructed from a row of staples; for the diabetic who is suffering a visual loss, even temporarily, it can provide a means of coping with a lower level of acuity. The templet measurement technique ought to be introduced at the time of initial visual impairment, since the procedure is most easily learned when useable vision remains. Not only the measuring technique can be learned at this time, but also the method for constructing the templet. These techniques, once learned, become a part of motor memory and can be used in any case of vision impairment—even total blindness. The templet technique is thus to be preferred to the use of magnifiers because it can provide a permanent solution to the problem of accuracy in insulin draw.

Making the Templet

Simply and economically, a templet of refill staples and a soft adhesive tape (masking, mystic, surgical, etc.) can be made; made according to the following procedure, it will be accurate. Set the insulin dose on the syringe. Break off a length of staples slightly longer than the length of exposed plunger. Remove a few staples at a time, until the length of staples fits snugly between the exposed plunger end and the syringe barrel. Wrap the length of staples, including one of the angles, with tape to insure permanence and rigidity. Check the accuracy of the templet.

Advantages of the Staple Templet

The chief advantage of this homemade device is its ready availability. If there is a prescription change or a templet has been lost, a homemade templet can be made on the spot. This templet is easy to construct and the inexpensive materials are found in most homes and office settings. For example, if one needs a template made when in a motel, the length of staples and the few inches of tape would be freely provided by the desk clerk. On the other hand, the commercial aids are infrequently available at pharmacies and mail-orders may require 6-8 weeks for delivery. Although their ready availability, freedom from cost, and ease of assembly make staples the preferred material for a homemade templet, other materials, e.g. plastic or metal tubing, will also work.

Important Note

A new templet is necessary when there is a change in the amount or type of insulin prescribed; when there is a change in the manufacture or model of the syringe to be used by the patient; if it becomes raggedy after much use.

Disposable syringes should be used since the plunger of the plastic disposable syringe is easier to control.

Technique for Drawing Up Insulin

—Assemble all equipment on a small, shallow tray or box.

—Mix insulin by rolling the vial gently between the palms of the hands.

—Cleanse the vial cap with an alcohol swab. Return swab to tray.

—Uncover the needle. *After the needle is uncovered, the syringe does not leave the hands until it is ready for disposal.*

In the dominant hand, hold the syringe near the needle hub as a pencil. With the other hand, hold the insulin vial firmly upright on the table, thumb and forefinger at the neck of the vial.

As the needle is brought to rest across the vial top, the free fingers of the hand holding the syringe will help locate the vial and steady the hand.

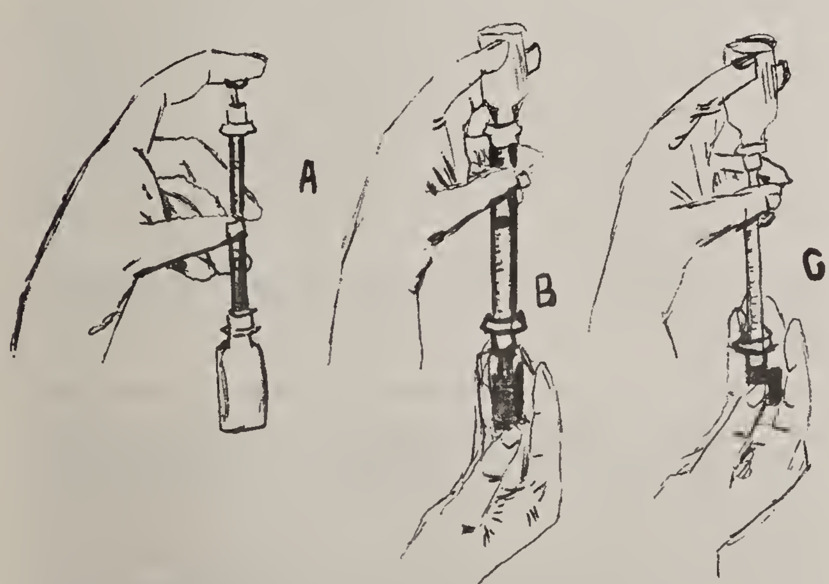
Draw the needle across the vial cap. There will be a small "click" as the tip comes off the metal ring onto the rubber. Rotate the syringe to the perpendicular and insert it into the vial. If the needle is not on the rubber, there will be resistance. Don't force it, as the needle will bend. Start over.

—*Draw air into the syringe to the amount of the insulin dose by placing the templet along the shaft of the plunger and seating it snugly. Remove the templet and return it to the tray for easy relocation.*

—*With the vial resting firmly upright on the table, insert the needle. Expel the air into the vial.*

—*Slowly invert the vial with syringe attached. Hold it in a vertical position in one hand, leaving the dominant hand free to manipulate the plunger. Keep the equipment in a vertical position until the insulin is fully drawn. (Figs. B and C)*

—*With the dominant hand, pull out the plunger approximately 1/4" farther than necessary to insert the templet. Position the templet along the plunger shaft. (Fig. B) Push the plunger up so that the templet is seated. The insulin in the syringe is the dosage prescribed. (Fig. C)*



Additional Procedures for Two Insulins in a Single Dose

—Make two templets. One templet should be made to measure units drawn first. The other templet is the length of the combined dose. Be sure the insulins can be differentiated tactually (e.g., a rubber band around one of the vials).

—Draw up air with the longer templet to the combined dose.

—Remove templet and insert needle in vial of insulin to be drawn second.

—Place the small templet along the shaft of the plunger, and expel air into the vial until the small templet is seated.

—Withdraw syringe with templet still in place.

—Insert needle into the vial of insulin to be drawn first.

—Remove templet and expel air.

—Draw up the first part of the dose, following the procedure described in the previous section.

—Remove the needle from the vial, keeping the templet in place. Return the vial to the tray.

—Keeping the templet in place, insert the needle into the second vial.

—Invert the vial, and remove the small templet, drawing up a few units.

—Set the longer templet with the end resting on the end of the plunger, and carefully pull out the plunger, steadying the templet with the thumb until the templet drops into place and is seated. (Fig. C) Do not expel any insulin back into the second vial.

—Withdraw the syringe from the vial with templet in place. If extra insulin was drawn, discard it by seating the templet.

—Remove the templet and proceed with injection.

Instructing the Blind Patient

CAUTION! This is not a complete insulin instruction. It is concerned with technique modification and presumes a considerable knowledge of diabetes and insulin management. Persons with a non-medical background should use this article with the consultation of an experienced nurse or clinician. Improper interpretation of insulin prescription can have serious consequences. It should be noted that insulin is a potentially lethal drug. In instructing the blind diabetic in the use of devices for nonvisual measurement of insulin, remember to consider his or her physical tolerance, mental alertness, etc.

ORGANIZE instructions and instructional materials thoroughly. Be consistent. Repeat instructions in the same terms and sequence. Be sure the patient understands the terminology you are using.

POSITION the patient. If the task to be learned is one he or she performed before, have the patient assume the familiar and comfortable position. If it is a new task, put the person in the posture best for him or her.

PROVIDE AMPLE TIME for the person to become familiar with the task. Have the person examine and manipulate thoroughly all materials and equipment used. Let the person observe and examine your demonstration tactually as you give verbal instruction.

INDIVIDUALIZE INSTRUCTION. If the person has had previous experience with the skill being taught, allow him or her to demonstrate present proficiency. Begin instruction at this level.

Experiment with possible adaptations and alternatives, e.g., other techniques of manipulation and/or use of assistive devices. Use short, frequent instruction periods. Do not rush instruction. Make sure that each step of the procedure is mastered before going on to the next step. Supervise the practice until you are reasonably sure that the patient will not be practicing an incorrect technique.

BE PRAGMATIC in your evaluation. Accomplishing the task is more important than the style of performance. Give plenty of positive reinforcement. (Nothing succeeds like success!) At the same time, be realistic and don't try to "con" the person.

—*Excerpts, additions, and format changes printed by permission of the author.*

Devices for Insulin Administration

With the use of sight, the insulin dose is measured by reading the scale printed on the syringe barrel. The insulin vial is first pressurized so that the liquid will flow easily and smoothly when it is withdrawn into the syringe. To then withdraw the proper amount of insulin, the pressurized vial, with the syringe inserted, is inverted, the syringe plunger is pulled halfway down the syringe barrel, and a column of insulin half the length of the syringe is drawn up. To measure the exact amount for a particular dose, the plunger is then pushed in expelling excess insulin until the plunger head is observed to align with the scale marking for the desired dose.

Mechanical characteristics of the syringe itself, rather than the printed scale, can be used to accomplish the same procedure. The distance between the plunger base, pulled out from the barrel, and some fixed point on the barrel itself, for instance its base, will stay constant for any specific dose drawn. (Refer to Figure 2 on page 7.) Devices for nonvisual measurement of insulin all work according to this principle: that is, insulin gauges, including those volume regulators built into the syringe itself, control the distance between the base of the syringe barrel and the base of the plunger—they fix the distance to which the plunger can be pushed or pulled, or they tactually or aurally indicate it. The height of any given column of insulin drawn up in a specific number of units will always correspond to a fixed distance between the plunger base and syringe base of a particular syringe or of a syringe with the *exact* dimensions—thickness of plunger base, etc. As Joyce Schulz points out, it is thus crucial always to use the same brand and model of syringe with a particular preset insulin gauge and to use only those brands and models of syringes in which dimensions are consistent from syringe to syringe.

Devices called needle guides can be equally essential in nonvisual insulin administration. Needle guides, as the name suggests, aid in centering the hypodermic needle on the vial's rubber stopper. Some needle guides also hold the vial and keep it steady.

Magnifiers constitute another category of devices for insulin administration with vision loss. For some persons with remaining useable vision, hand or spectacle magnifiers can aid in both tasks—guiding the needle to the vial stopper and measuring the insulin dose in the syringe. While these magnifiers make all features of syringe and vial appear larger, magnifiers designed to attach to the syringe itself enlarge the lines and numbers of the unit scale only.

From our survey of rehabilitation and health professionals and of consumers, all of these devices would appear to have potential advantages and limitations. The appropriateness of any device ultimately depends on the particulars of a person's individual characteristics and circumstances of daily life. The following guide compiles descriptions of the devices with comments on their utility under various conditions.

For participating in the survey, we would like to thank in particular Ruth B. Carr, Richard M. Connors, Davide Marletta, Laura V. Marletta, Judith W. Oehler, Alice Raftary, Joyce Schultz, and Allene R. VanSon. We are also most grateful to Brian Collins of Toronto, Canada, for supplying not only valuable information but also some actual equipment purchased from the Canadian National Institute for the Blind. While some comments are not attributed to individuals, lengthier discussions bear the initials of their principal author.

Resources

Insulin Gauges

Andros IDM

Measures 1″ x 4″. Made of stiff but thin and flexible sheet plastic. Unit scale is printed the length of the gauge. Above unit scale is cut a slot for syringe's fingergrips. A nurse or physician is to cut the gauge at the unit line corresponding to the prescribed insulin dose. During use, the fingergrips of the syringe fit into the slot with the needle extending upward and over the gauge's arrow-shaped head. Then the plunger is pulled until the disk of the plunger base snaps past the edge of the gauge, already cut for the desired dose. The plunger is then pushed in until the disk is in contact with the edge of the gauge to set the dosage.

Essential features: For use with Becton-Dickinson's #8409 Plastipak U-100 disposable syringes *only*. Unit scale calibrated in 2-unit gradations.

Advantages: Scale is precisely calibrated and consistent for individual gauges. The slot fot syringe's fingergrips is precision cut to admit only the Becton-Dickinson #8409 Plastipak U-100 disposable syringe, for which the scale is calibrated—an effective safety precaution.

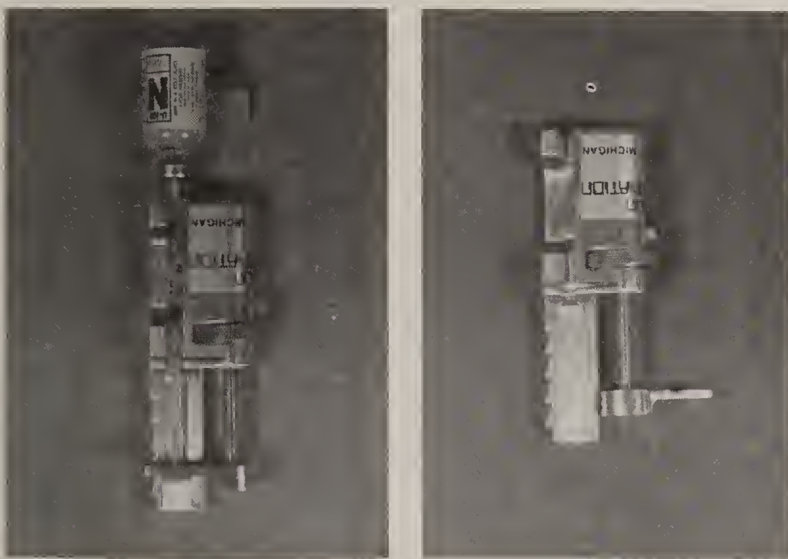
Disadvantages: Flimsy. Can be difficult to hold firmly while withdrawing plunger of syringe—also difficult to teach because there is no clear-cut step-by-step technique for solving this problem. (J.W.O.) Flexibility can cause dose to be off by several units if force is applied during measurement; ability to bend inspires mistrust. (B.C.) Can be quite difficult to cut evenly at proper unit line. Cannot be set by the visually impaired user. The 2-unit gradations of the scale make measuring odd numbered doses less accurate. Single IDM cannot be used to measure mixed doses or to change dose.

Solution: Several gauges may be ordered: one for intermediate acting insulin, one for combined dose of intermediate and regular insulin to accomplish mixed dosage. Others may be ordered and cut for predicted dose changes.

Independent Living Aids
11 Commercial Court
Plainview, NY 11803

Price: $3.50
Order No.: 074300

Cyberon Adjustable Gauging Device



Measures approximately 6″ x 2″. Prototype machined from metal alloy. Production models will probably be injection molded plastic. The central body of the device is basically rectangular with a "tongue" extending from body at lower left corner. A trough is machined on face along left edge above "tongue." This trough will accept the syringe barrel while a horizontal slot at base of trough will hold the syringe fingergrips.

During use, the syringe is held in trough by friction. The plunger extends from body of the gauge and down the "tongue." A threaded rod screws into base and through a thumbwheel fitted into body of gauge; at the base of this rod is a metal "flipper" that can be swiveled to hook over plunger shaft so that outside edge of flipper pushes against inside edge of the plunger base disk. Each full revolution of the thumbwheel moves the "flipper" a distance equivalent to one unit on the syringe. The thumbwheel is indexed so that it clicks each time a revolution is completed in the forward direction that increases dosage. In the reverse direction, no click is audible, but a resistance is felt when the revolution is completed. Notches cut into the left side of the "tongue" indicate tactually 10-unit increments as a guide to the dosage. The gauge may be preset before the needle is inserted into the vial; the plunger is pulled to draw up excess insulin, then pushed to expel excess back into vial until "flipper" stops movement at correct dose. Or the gauge may be set with the needle already inserted, a procedure which will pull out the plunger, filling the syringe gradually, one unit per turn of the thumbwheel. Because dosage setting is thus adjustable independently by user at time of use, device is suitable for measuring mixed doses of insulin. The physical design of the gauge allows the syringe to remain in the gauging unit while injection is administered.

A patent application has been filed on this device, and Cyberon Corporation is presently exploring a variety of methods for manufacturing, marketig, and/or licensing this device. (For further information, contact Eliot Friedman, President of Cyberon Corporation, at the address below.)

Essential features: Prototype has been machined in two models: one to fit B-D Lo-Dose U-100 syringe, one to fit Monoject Lo-Dose U-100 syringe. In production, one model may be developed to accept either brand of disposable 1/2 cc syringe.

Advantages: Accurate. Beautifully machined. Ingenious and functional design.

Disadvantages: Setting the device can seem to require a good deal of time—30 seconds to several minutes per injection. During this time, holding insulin vial steady can be a problem. Count of clicks can be lost without high degree of concentration, good hearing, tactual sensitivity.

Cyberon Corporation
1175 Wendy Road
Ann Arbor, MI 48103
(313) 994-0326

Dos-Aid Syringe Filling Device

Measures 7″ x 1 1/2″. Made of rigid plastic. The two-inch cradle at top holds insulin vial; attached by screws it is allowed to slide on main body of guide. The vial cradle is moved up or down to lengthen or shorten distance between insulin vial and syringe to adjust to specific syringe type. The middle consists of two blocks, side by side, with a vertical gap between them to hold the syringe barrel. Amount of separation adjusts to fit girth of specific syringe type. At the base of these blocks is a slot for the syringe's fingergrips. The bottom third of the device holds a block which can slide forward or back to set the guide for the desired insulin dose. To set, the syringe barrel rests in the syringe trough between two middle blocks with fingergrips in the fingergrip slots. The plunger is withdrawn to desired dose and the plunger stop (block) is pushed to rest against the disk of the plunger base. The screws are tightened. Now the block controls the distance to which the syringe plunger can be pulled and thus determines the insulin dose which can be drawn up. To be set by a health professional.

Essential features: Designed to measure single dose only. Designed for use with 1 cc syringes only; cannot be used with lo-dose syringes since even the closest position of vial cradle is still too distant for any lo-dose syringe to reach.

Advantages: Convenience of having vial holder, needle guide, and insulin gauge in one unit. Easy to locate and handle because of large size. Useful for limited dexterity such as that caused by one-handedness or severe neuropathy. (R.B.C.)

Disadvantages: Bulk makes it cumbersome to carry around daily. Screws can loosen and settings can change without user's awareness. Must be preset by sighted help. The use of various brands/types of syringes is not absolutely prevented. The slot for syringe fingergrips is wide enough to accommodate any brand or type of syringe, potentially causing dosage error. Dosage error can also result from ability of syringe to jostle in trough. (J.N.S.)

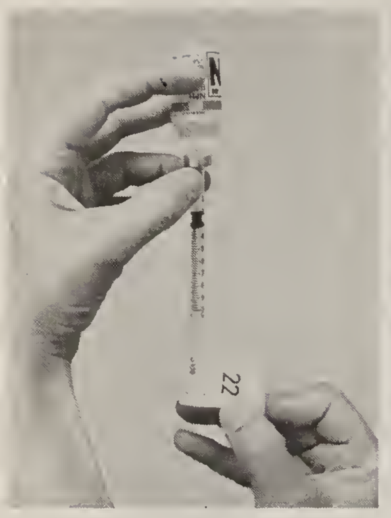
Solutions: Engineers at the American Foundation for the Blind are presently working on an improved Dos-Aid. Now in prototype, the device would have the capability of measuring a mixed dose, indicating automatically when the insulin vial is empty, and permitting the insulin dose setting to be varied at will.

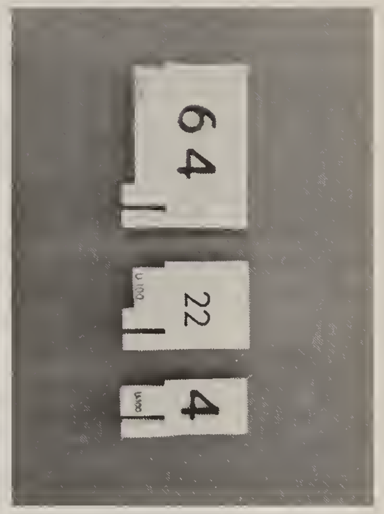
American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011

Price: $17.95
Order No.: NES-563

Centre Louis-Hebert Inc.
1270 Chemin Ste-Foy (4e Etage)
Quebec - G1S 2M4
Tel.: (418) 687-3470

Insulgage Loading Gauge





Measures 1 5/8″ in width. A 1/4″ thick rectangle, the height varies according to insulin dose for which the gauge is calibrated. High quality, durableplastic. Individual gauges are cut to length by manufacturer; the length corresponds to distance between the base of syringe plunger and the base of syringe barrel for a specific insulin dose drawn by a Becton-Dickinson Plastipak #8409 Long U 100 Syringe only. Gauges are produced in sizes ranging from 4 units U-100 insulin to 85 units; within this range, sizes are available only for even numbered units or for numbers of units which are multiples of 5. For mixed doses and anticipated dose changes, a variety of gauges may be ordered.

During use, the shaft of the syringe plunger fits into the hollowed-out vertical edge, and the disk of the plunger base slips into the horizontal notch. (Refer to "Measuring and Injecting Insulin" on page   of this issue.). Body of gauge contoured for firm grasp. Face of gauge labeled with insulin dose, choice of media: black large print numerals; 1/2″ tall; raised plastic numbers; or braille. Both braille and raised numbers are also available.

Essential features: For use with a Becton-Dickinson Plastipak #8409 Long U-100 syringe only.

Advantages: Normal hand-motor control is adequate dexterity for use; neuropathy does not significantly interfere with technique. Mixed doses can be measured with use of 2 gauges—one for short-acting insulin and one for combined dose of short-acting insulin and intermediate-acting insulin. Simplicity and sturdiness of device makes practical the techniques of injecting regular insulin before each meal for tight control. (D.M.) (J.W.O.)

Disadvantages: Some consumers report long waits for order to be filled. Device has a 2-unit play in the notch where plunger base rests, which can cause a 2-unit dosage error if care is not taken to perform technique of measurement consistently.

Solutions: Dosage error may be avoided by consistently pulling plunger out farther than necessary, inserting plunger base into notch, plunger shaft into hollowed edge, and pushing in until gauge prevents plunger from further movement. Plunger base will always be resting against back of the notch, with base of syringe barrel fixed against top edge of gauge. Distance between plunger base and barrel base will always be consistent; dose will be constant. (D.M.)

Meditec, Inc.
9485 East Orchard Drive
Englewood, CO 80111
(303) 771-4863

Price: large print label—$3.50
braille label— 4.00
raised numbers— 4.50
To order: obtain order for from Meditec

Morris Watts Insulin Gauge

Measures 5 1/2″ x 3/4″ approximately. Made of durable plastic. Consists of a long, narrow foundation into which are molded two sturdy raised clips and on which are mounted two adjustable blocks. The first set of clips, prongs, hold the syringe barrel; an inch below, a second set, a raised horizontal channel, holds the fingergrips of the syringe. On the bottom two-thirds of the foundation, the two stops are attached by screws to a vertical slide which allows them to move forward or back. The screws tighten the stops in the desired position to regulate the distance to which the syringe plunger may be either pushed or pulled. The plunger can move only between these two blocks. They allow a mixed dose to be drawn up.

During use, the syringe barrel and fingergrips are fixed in their respective clips with needle extending over the top edge of guide. The first "adjusta-stop" is shaped like the letter "H". While the narrow space between the uprights allows the plunger shaft to rest on the crossbar, it also catches and holds the disk of the plunger base. It is set at a distance corresponding to the dose of the first insulin and prevents the plunger from being pulled back farther than the distance needed to draw up prescribed dose of second insulin.

To draw up a mixed dose, a disposable syringe still covered by its needle guard is placed in the guide by slipping the syringe plunger into the first stop at the space between uprights of "H" and holding disk of plunger base against first stop while pulling syringe barrel forward with other hand until syringe fingergrips come to rest properly in the riase horizontal channel; then the barrel's midsection snaps into top prongs. Finally, the plunger is withdrawn until the disk of its base rests against second stop. The needle guard is removed, and the needle is inserted into first insulin vial. Plunger is pushed all the way to first stop to inject air and pressurize vial; because its motion is arrested by first stop, syringe will still contain a column of air equal to first insulin dose. Ideally, the plunger is then withdrawn quickly and smoothly so that insulin from the vial rushes into syringe and through air already contained. The first insulin thus fills barrel from bottom of space upwards in an amount greater than its prescribed dosage. The manufacturer recommends flicking the syringe barrel with the fingers at this point in order to disperse any air bubbles which might cause dosage error. Then excess insulin and the column of air on top are expelled into vial of first insulin by pushing plunger in until first stop again arrests its movement. With plunger thus pushed all the way to first "adjusta-stop," correct dose of first insulin is measured.

To measure second insulin, syringe is removed from first vial, and needle is inserted into vial of second insulin. Plunger is pulled to second (bottom) "adjusta-stop" to withdraw prescribed dose of second insulin for mixed dose. The manufacturer recommends that either a physician or nurse set this device and demonstrate its proper use; practice should proceed under medical supervision.

Essential features: For either B-D Plastipak Lo-Dose Syringe or Monoject disposable syringe in either 1cc (full size) or 1/2cc (lo dose).

Advantages: Screws, washers, and plastic are of highest grade material so that the "adjusta-stops" are fixed tightly and reliably at desired settings. Lightweight and compact. Durable. Fingergrip channel is designed to hold B-D Lo-Dose Syringe securely. With use of magnifying glass, consumer with low vision can set the device independently. (B.C.)

Disadvantages: Cannot be adjusted at will without vision. No provision for using device to measure and inject pressurizing air into second insulin. Monoject 1/2cc syringe fits less snugly into fingergrip channel allowing the possibility of some play and dosage error. Ability to use various brands and models of disposable syringes has potential for dosage error: once the device is set for one brand and type of syringe, it is accurate *only* for that brand and type, even while others will fit device. Large air bubbles replacing insulin and causing dosage error *can* occur if plunger is not withdrawn quickly and smoothly. As explained above, the first insulin must rush past a column of air already standing in the syringe. If the plunger is withdrawn too slowly, insulin does not rush in with sufficient force to flow under the air and displace it; rather, air is trapped at bottom of dosage column so that air bubbles form. In our limited experience and evaluation, the manufacturer's recommendation to snap barrel repeatedly does not always disperse bubbles so that insulin dose is corrected.

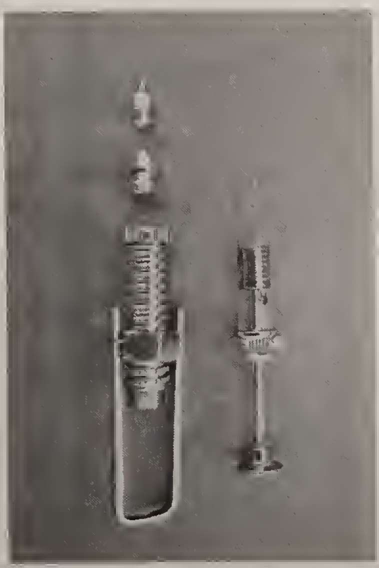
Solutions: To pressurize second insulin vial, an arbitrary amount of air may be injected with syringe before it is place in guide. To avoid interchanging brands and models of syringes and to avoid play noticeable with Monoject 1/2cc syringes, consistently use B-D Plastic Lo-Dose Syringes. To avoid air bubbles, practice proper technique under medical supervision until perfected or have syringe checked by sighted help.

Canadian National Institute for the Blind
350 East 36th Avenue
Vancouver, B.C.
Canada V5W 1C6

Homecraft Department
Canadian National Institute for the Blind
1929 Bayview Avenue
Toronto, Ontario M4G 3E8
Canada

Price: $3.25
(Canadian currency)

AFB Insulin Syringe



Measures 5 1/2″ in length with plunger fully extended; barrel is 1/2″ in diameter. Barrel consists of brass nickle-plated casing which encloses a 2 cc glass syringe barrel. Plunger is stainless steel. The principal fitting is a U-shaped brace or plunger stop. Also brass nickle-plated, the ends of the brace pivot on a nut which moves up or down the barrel of the casing by rotating along the screw-thread machined the entire length of the casing. When the brace is in line with the metal casing, it serves to catch the plunger base in the notched U of the brace, fixing the distance between plunger base and syringe base. This distance corresponds to a particular dosage of the interior glass syringe. This distance, and thus the dosage, is monitored and set by rotating the nut to which the brace is welded. Beginning with nut in position closest to needle end, each quarter rotation on screw-threaded casing produces an audible click; each click indicates an increase of 1/20 milliliter of liquid. The syringe may be used to measure any strength insulin—U-40, U-80, or U-100. The number of clicks to turn the nut must be determined mathematically for a particular insulin strength. For example, to determine number of clicks for a dose of 20 units of U-100 insulin, consider the following givens and reltionships: each click indicates 1/20 milliliter of liquid; each milliliter of U-100 insulin contains 100 units of insulin. Thus each click withdraws 5 units of insulin because 1/20 (number of milliliters per click) x 100 (number of total insulin units per milliliter of liquid in U-100 insulin) = 5 (units of U-100 insulin per click). Then 4 clicks would draw up the desired dose of 20 units (4 clicks x 5 units per click = 20 units of U-100 insulin). By turning nut so that 2 clicks are heard, the brace is in place to withdraw plunger for filling syringe with 10 units U-100 insulin; 3 clicks for 15 units; and so on.

With the U-shaped plunger stop so set for the correct dose, the plunger is first withdrawn fully. Then the U-shaped stop is pivoted up to the position which aligns with syringe barrel and plunger. Plunger is next pushed in until the disk of the plunger base is caught and halted by the notch in the bottom of the U-shaped stop: this procedure measures air to pressurize insulin vial. U-shaped plunger stop is pivoted down at a right angle with device barrel, to make way for the plunger to be pushed in. Thus air is injected into vial, vial with syringe still inserted is inverted, and plunger is then withdrawn to furthest position drawing up a quantity of insulin greater than required dose. To measure correct dose, U-shaped stop pivots once more to align with device barrel, and plunger is pushed in until disk of base is halted by preset plunger stop, as in measurement of pressurizing air. This maneuver expels excess insulin back into vial, and correct dose remains in syringe for injection. Entire unit is used.

Essential features: Requires addition of stainless steel needle or disposable microfine needles. Requires sterilization. Unit consists of seven separate parts: metal barrel casing; brace on nut; glass interior syringe barrel; needle connector; plunger shaft; plunger head (which can unscrew from plunger shaft); nut for base of metal barrel.

Advantages: High quality, durable materials. Precision-made. Independently adjustable. Can be used to change dose at will without sighted help. Could be used for multiple daily injections of regular (rapid-acting) insulin for tight control.

Disadvantages: High level of concentration and hearing and/or tactual sensitivity required to hear clicks or feel resistance which indicates dosage increments as stop is rotated on barrel. Because of number of separate parts, reassembly after sterilization can be difficult, especially with vision loss. U-100 insulin can be measured in 5-unit increments only. U-40 insulin can be measured in 2-unit increments (since each click = 1/20 milliliter, and 1/20 milliliter of U-40 = 2 units of insulin); however, U-40 insulin is being phased out. Math to determine number of clicks for desired dose can frustrate some persons. Difficulties can discourage reliance on device and thus independence. (J.W.O.)

American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011

Price: $26.00
Order No.: MES 260

Boers & Co. B.V.
Postbus 67
3100 AB Schiedam
Rotterdam
The Netherlands

B-D Cornwall Syringe

Body of the principal mechanism measures approximately 3″ in length and 1/2″ in diameter. In its pronged opening, this metal cylinder holds a Becton-Dickinson glass 1 cc U-100 syringe, its barrel extending fully from the cylinder with the barrel base gripped firmly within the prongs. The cylinder itself contains the glass plunger which has been inserted through a metal spring. A metal plunger enters the base of the metal cylinder through a threaded metal regulating sleeve which screws into the base of the metal cylinder. Inside the metal cylinder, this threaded sleeve acts as a plunger stop; it fixes the distance to which the glass syringe plunger can be withdrawn and sets the prescribed dose of insulin. The more the metal sleeve is screwed into the base of the metal cylinder, the farther the glass plunger is set into the glass syringe barrel, and the smaller is the dose thus set. The two lock nuts at the top of the metal sleeve are to hold the setting tight. The metal plunger which slides through the sleeve also makes contact with the disk of the glass plunger inside the metal cylinder. With device held vertically and needle inserted into inverted vial, the function of the metal plunger is to push the glass plunger all the way into the glass syringe barrel, an action which expels air into the insulin vial and compresses spring around glass plunger. The metal plunger is then released, and this action allows the spring compressed around glass plunger to recoil and retract glass plunger but only to position of regulating sleeve, which acts as plunger stop. Thus the desired dose of insulin is withdrawn.

The two circular grips welded to the exterior of the cylinder enable the fingers to grasp the device firmly in order for the thumb to squeeze the plunger.

Essential features: Requires the addition of reusable stainless steel or disposable microfine hypodermic needles. Requires sterilization. When disassembled, consists of five separate components. Measures single dose only. To be set by health professional; can be ordered by doctor or nurse only.

Advantages: Can be set accurately (with the use of sight). Metal components are durable; glass syringe is replaceable. Withdraws proper dose smoothly and quickly.

Disadvantages: Must be set by sighted help. Without careful and consistent technique, lock nuts *can* unscrew and change setting (especially increase) during use or during disassembly sterilization and subsequent reassembly. (J.O.W.) (R.M.C.) Must be reset after each sterilization.

American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011

Inquire for price and availability

Independent Living Aids, Inc.
11 Commercial Court
Plainview, NY 11803

Price: $17.50
Order No.: 384890

Replacement Syringe
Price: $5.95
Order No.: 658225

Click-Count Syringe

Syringe measures approximately 5 inches in length. Consists of metal tip for connecting needles, glass barrel marked for one-unit increments of U-100 scale, metal base of syringe barrel, through which passes the shaft of the syringe plunger. The metal plunger shaft is notched at 2-unit intervals on one flat side, and the disk of its base is flattended on one side. Inside the metal base of the syringe barrel, the plunger shaft is gripped by two parallel pins. When the disk of the plunger base is turned so that its flat side aligns with a tactually prominent screw on base of syringe barrel, then the notched side of the plunger shaft is pulled under one of the parallel pins. Each notch clicks against the pin as plunger is withdrawn. Resistance is felt and a click is heard for each 2-unit increase. Thus air would be measured to pressurize vial. To inject air into vial, the plunger shaft would be turned one quarter revolution clockwise to free notched edge from parallel pins; this motion turns smooth sides of the shaft against the parallel pins—the "glide" position. Now the plunger may be pushed in smoothly to inject vial with measured amount of air. To withdraw prescribed dose of insulin, the disk of plunger base is turned clockwise until the flat edge again aligns with screw on syringe base. Now shaft is in position to indicate by clicks 2-unit increments as it is withdrawn. To withdraw plunger for insulin measurement, it is gripped between thumb and index finger close to syringe barrel. The grip is tightened and loosened with a squeezing action against base of syringe barrel. With the grip thus maintained close to barrel, the syringe shaft feeds through the fingers in movements of one notch at a time, always signaled by a click indicating 2 units of insulin. The dose can be checked by counting the exposed notch on the shaft with a fingernail. The number multiplied by two equals the number of units of insulin withdrawn into syringe. To inject, plunger shaft is turned to glide position and plunger is pushed in.

insulin withdrawn into syringe. To inject, plunger shaft is turned to glide position and plunger is pushed in.

Essential features: Requires sterilization. For use with U-100 insulin only. Can measure mixed doses. Manufacturer provides instructions.

Advantages: Simple in concept, beautifully machined, high grade materials. Accurate with careful, consistent, painstaking technique. Any dose may be measured at will independently.

Disadvantages: Requires highest degree of concentration, manual dexterity, hearing or tactual sensitivity, and patience. Slightest extra pressure during measurement can cause plunger to slide off setting to which it has been pulled.

Solutions: Practice under medical supervision is strongly recommended.

Hypoguard Limited
Dock Lane, Melton
Woodbridge, Suffolk
England IP12 1PE — Price: L 6.00

Needle Guides

AFB Needle Guide

Aluminum nut machined to fit vial cap of Eli Lilly insulin, AFB Needle Guide can be used with other brands but may not fit as snugly or may resist application and removal. Funnel-shaped interior of top guides needle to rubber stopper. Hexagonal base provides flat edges for gripping this relatively small object, but tactual sensitivity is still required. (A.R.V.) Sterilize guide to prevent needle contamination. Made of aluminum which may scratch and burr to catch or blunt needle.

American Foundation for the Blind
15 West 16th Street — Price: $2.50
New York, NY 10011 — Order No.: MES 168

Centrepoint Needle Guide

Aluminum sheath, 1 3/4″, provides cradle for narrow vials of Nova range of insulins, which are manufactured in Denmark, distributed in Western Europe and United Kingdom, and have been recently marketed in the United States. Friction holds the guide in place, topped by high quality medical grade stainless steel funnel which guides needle to vial stopper. Sterilization by boiling is recommended preparation before each use.

Manufacturer reports production of another model to fit the Burroughs Wellcome range of insulin available in the United Kingdom. In addition, manufacturer intends to produce a Centrepoint to fit Eli Lilly brand of insulin in the near future.

R.N. Beard
15 Kings Ride
Blackfield
Southampton SO4 1ZN
England — Price: L 7.00

Holdease Needle Guide

Plastic cradle to hold vial aligned with trough to hold syringe. Barrel of syringe is held by clip molded onto trough while needle protrudes through slot in center divider to penetrate vial stopper on target. To prepare for use, cleanse divider with alcohol swab. Clean in warm suds; do not immerse in water hotter than 150°F (well below boiling). Ideally, no part of guide requires sterilization since no part interrupts path of needle to vial stopper. Manufacturer provides clear directions for use. Designed for standard American insulin vials but can be used with tall, narrow bottles common in Europe. Keeps vial and needle steady for easy handling as a single unit, even for those having coordination problems. (D.M.) Useful with staple templet or Insulgage. (R.B.C.)

American Foundation for the Blind
Consumer Products Department
15 West 16th Street — Price: $11.75
New York, NY 10011 — Order No.: MDC 8120

Independent Living Aids, Inc.
11 Commercial Court — Price: $9.95
Plainview, NY 11803 — Order No.: 37022

Meditec, Inc.
9485 East Orchard Drive
Englewood, CO 80111 — Price: $9.75

Location Tray

Heavy, durable plastic foundation is impressed with shape of insulin bottle aligned with trough for glass insulin syringe. The bottle well will accept either the elongated European vial or the stocky American type; the syringe trough will accept *only* long, thin glass syringes such as type used in Click-Count Syringe. The Click-Count Syringe fits perfectly. With bottle and syringe aligned in tray, needle is directed to center of vial stopper. When in vertical position for insulin withdrawal, tray does not hold syringe and vial tightly. Plastic is smooth and rigid: it cannot hold vial and syringe by friction, and it has no clipping features. Manufacturer does not specify sterilization procedure.

Hypoguard Ltd.
Dock Lane, Melton
Woodbridge, Suffolk
IP12 IPE
England
Tel. 03943 7333

Price available on request from manufacturer.

Syringe Magnifiers

When contributors to this issue of AAR were surveyed regarding the available syringe magnifiers, it was revealed that most insulin syringe magnifiers have been found to be of limited use especially to the severely impaired population. Joyce Schulz offered the following information in response to a request for an evaluation of syringe magnifiers:

> For people with sufficient vision to read syringe calibrations visually, Monoject "Half CC" or B-D Lo-Dose disposable syringes are available. These syringes measure 50 units of insulin or less and are easier to read as each unit on the syringe is marked in large numbers.
>
> For those who desire more magnification, Char-Mag Company of Milwaukee manufactures a syringe magnifier that fits the entire length of the syringe and does not distort the numbers which are two advantages this device has over other syringe magnifiers. However, if a person has sufficient visual loss, possibly coupled with fluctuating vision, so that he or she cannot read the syringe, it is recommended that for safe and accurate measurement a non-sighted technique be used. Very often the magnification is sufficient to make the numbers readable but not the line calibrations between numbers.

For independent evaluation and inquiry, the following resources for insulin syringe magnifiers exist.

Char-Mag Syringe Magnifier

Device is a 2½″ bar magnifier that clips onto a B-D Long Plastipak U-100 Syringe or the Monoject 1 cc disposable plastic syringe. It extends the entire length of the syringe.

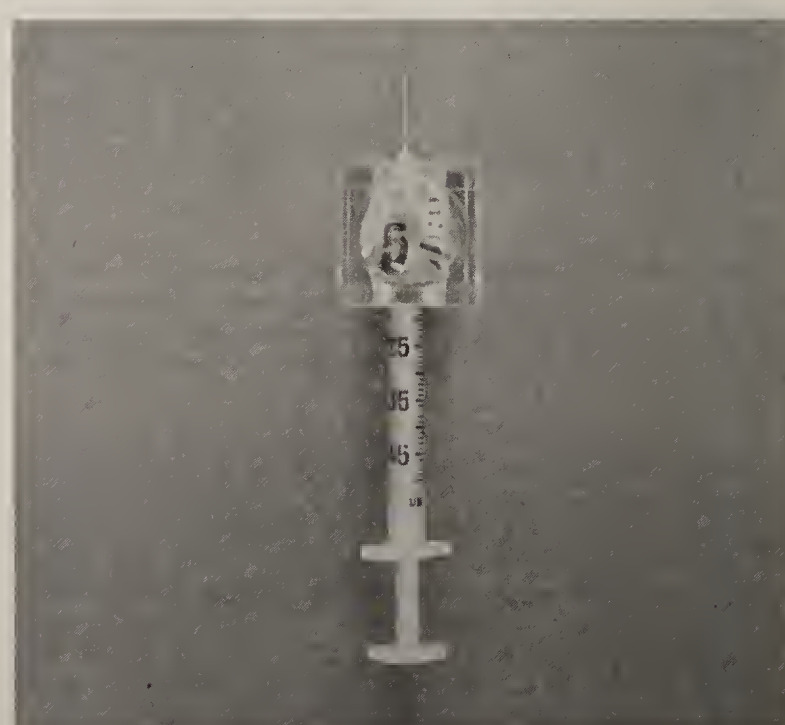
American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, New York 10011

Price: $4.50
Order No. LMC 7100

Independent Living Aids
11 Commercial Court
Plainview, New York 11803

Price: $4.50
Order No. 074300

Monoject Syringe Magnifier



Device is a 3/4″ circular magnifier centered in a rectangular plastic housing that clips onto syringe in area of dosage to be measured. Will fit any plastic disposable insulin syringe, andy brand, any type.

Monoject
Division of Sherwood Medical
St. Louis, MO

Price: $1.98 (suggested retail)
Available through local pharmacies.

GLUCOSE LEVEL MONITORING

According to clinical definition, diabetes control means maintaining the concentration of glucose in the blood at levels within the range considered normal. Amount, kind, and timeing of food intake, of exercise, and of insulin injected can interplay to establish and maintain the blood glucose level within normal ranges. (Refer to "Diabetes: Some Physiological Considerations for the Blind Person.") Because the distinct but interrelated influences of diet, exercise, and insulin therapy converge to increase or decrease the amount of glucose in the blood, the blood glucose level can be seen to reflect the effectiveness of efforts to manage any one, or all, of the points of the network: diet, exercise, insulin therapy. Monitoring blood glucose levels is thus a crucial aspect of diabetes control. When levels rise above or fall below normal range, they can signal need for adjusting diet, exercise, or insulin dose.

Equipment for Urine Glucose Analysis

Either blood or urine may be tested to detect the concentration of glucose in the blood. Until recently, the method commonly used was the procedure of testing a urine specimen for glucose. Glucose in the urine often, but not always, results from higher than normal concentrations of glucose in the blood, since it is the function of the kidneys to cleanse the blood of any impurities (in this case, exessive sugar) and spill the impurities into the urine to be voided from the body. Thus, the percentage of urine sugar can reflect the percentage of blood sugar. (Refer to "Home Blood Glucose Monitoring for the Visually Impaired Diabetic" for an explanation of the limitations on interpreting blood glucose levels from urine glucose levels.)

Commercial Reagent Tests

The basic equipment for urine testing is (1) a second specimen of urine voided 30 minutes after a first void, during the hour before a mealtime, and (2) one of the several chemical tests available. The chemical tests consist of reagent material which reacts chemically with any sugar present in the urine and which indicates that reaction by changing to one of several specific colors; the specific color correlates with a specific percentage of sugar in the urine. (For a detailed evaluation of the four major commercial reagent products—Clinitest, Tes-Tape, Diastix, and Clinistix—consult the *Joslin Diabetes Teaching Guide*.) The test is accomplished by dipping the strip of reagent material into the urine specimen and matching the strip's resultant color change to a color chart labeled in respect to percentages of sugar indicated. With the Clinitest product, tablets are dropped into a carefully prepared urine specimen, and the entire specimen is observed for a change in color.

Obviously, vision loss can either interfere with comparing the color change to the color chart or can make it impossible. Even with remaining light and color perception, matching the colors can be a problem, since for all the products the closeness in hue of the individual colors can render them difficult to distinguish. For example, the Tes-Tape, approximately 1/4 inch wide, changes from yellow, to light green, to darker green/blue, to darkest green/blue. Though it might be possible to discriminate the extremes—yellow to indicate sugar-free, as distinguished from darkest green/darkest blue to indicate 2% or more—it can be highly problematic to identify the middle ranges. Likewise, Diastix colors have been perceived as too close in hue for certain discrimination—blue, light green, dark green, olive green, light brown, dark brown—to indicate certain percentages of sugar. A larger surface of reagent material has been found helpful to some people; the color change of a longer than normal strip of Tes-Tape, even though still narrow, can sometimes be distinguished with remaining vision. The pre-cut reagent strips called Diastix come in a larger, 1/2″ wide size, under the trade name Mega-Diastix. For some people the color changes of this product are distinguishable.

Audible Urine Analyzers

Electronic devices which can sense the specific color changes on reagent material and which can audibly signal the specific color provide an alternative to sight in testing urine for glucose percentage.

The Uricator, manufactured by Science for the Blind, electronically detects and compares the color changes on a strip of Lilly Tes-Tape; it audibly indicates the color and thus the glucose percentage. The cassette tape which accompanies the *Uricator* provides the technical description of the device along with step-by-step instructions for operating it, as follows.

Housed in a black plastic box, which measures 5″ x 4″ x 1 1/2″, the *Uricator* operates on a nine volt battery. The box rests on four small rubber feet. On the top surface of the box toward the front is a row of four push buttons; behind the push buttons on the right is a small toggle switch, which turns the unit on. To the left of the toggle switch is the test block consisting of two small, parallel bars about 1/2″ apart. The sensing window lies in the space between the two bars. A hinged cover closes down between the two bars and over the sensing window.

The device operates as follows. A urine specimen is first prepared in the usual way. A one or two inch strip of Tes-Tape is pulled from the roll and dipped in the urine; after a wait of one minute, the wet tape is placed in the slot and over the sensing window, between the two raised bars, and the hinged lid is closed and held down over the tape to keep it flat and to keep out extraneous light. Under the tape, the sensing window consists of a square of transparent plastic covering a hole through which a light from inside the box shines onto the under side of the tape, then reflects back through the hole to the sensor. The sensor's response is proportional to the color of the tape. With the hinged cover held down lightly on the tape, the four buttons are pushed in succession, beginning with the leftmost button, until one of the buzzers sounds, indicating the sensor's response. If the first button sounds (yellow), it indicates no sugar; if the second buzzes (light green), 1/10%; if the third (darker green/blue), it signals 1/4%; and if the fourth (darkest blue/green), 2% or more.

One of the critical aspects of this test is the one-minute lapse of time between dipping the Tes-Tape into the urine and testing for the color change; this exact amount of time is required for the reagent material to respond to any percentage of glucose and change colors. So that the person using the *Uricator* does not have to time the minute somehow, the timer is built into the unit. The Tes-Tape is dipped into the urine *just before* the toggle switch activating the machine is switched on. Switching the toggle switch to "on" not only activates the device but also starts the one-minute timer built into the machine; a buzz sounding from within the box indicates that the critical one minute has elapsed; the Tes-Tape, having made any color change, is ready for detection. The machine will then be active, capable of sensing and indicating the specific color change, *only* for the next *30 seconds*. Within that 30 seconds it is crucial to place the wet tape into the slot of the testing block, pull down the hinged lid, hold it gently down over the tape, and push the testing buttons in succession, until one sounds. If the test has not been completed within the 30 seconds following the "activated" buzz, then the machine must be turned off, and the test performed all over again through each step of the sequence using a new strip of Tes-Tape. The original strip will not give accurate results for a second test.

The time limit of 30 seconds is said to be adequate for most *practiced* users. It is emphasized that for initial tests with the device, the user should practice with sighted help so that double-checks may be made on the tape's color change and the device's audible signal. For persons who have access to sighted help and to a *blood* glucose monitoring device, the results of the Uricator analysis may also be compared with those of direct blood glucose testing. (For one *Uricator* user in the Boston, Massachusetts, area, the *Uricator's* results compared favorably with the results of her blood glucose

monitor, whose digital display of glucose percentage was read by family members.)

So far, one limitation of the *Uricator* has been noted: its accuracy depends on the accuracy of the reagent material used, Tes-Tape. In many circles there is some controversy regarding the accuracy of Tes-Tape; it is felt that the color changes in the upper ranges are too ambiguous to make the tape reliable for glucose percentages above 1/2%.

But some *Uricator* users have reported much satisfaction with the device. One person interviewed compared the results of the Uricator with other methods of urinalysis undertaken with sighted help: she observed that the *Uricator* results were, for her, just as accurate. Certain overall contributions of the device have been reported also. To a homemaker, who manages diabetic control independently during daylight hours, the *Uricator* gives the capability of objectively confirming any high glucose levels; with this information, she can decide either to plan different foods or eat less for a few meals, or to take time out for walking, stationary cycling, or swimming—activities in her regular exercise program. She states enthusiastically that using the *Uricator* makes her feel more in tune with herself and more in control of her life. The catalogue of Science for the Blind tells of the experience of another *Uricator* owner: "During a bout of flu he monitored his sugar level closely, eating or not at bedtime, depending on the level, and not disturbing his wife to help with a test in the middle of the night."

Uricator

Science for the Blind Products
Box 385
Wayne, Pennsylvania 19087
(215) 687-3731

(Calls for orders or information are taken 10 a.m. to 10 p.m. each day.)

Price: $125.00
Order No.: T-16

The Hypo-Test Audio Urine Meter is produced by Hypoguard Ltd. in England and is not yet available in the United States. However, upon approval by the Food and Drug Administration, the company plans to explore with the American Foundation for the Blind the possibility of marketing the *Hypo-Test* in the U.S.A. Like the *Uricator*, the *Hypo-Test* is a compact plastic box; the top surface contains the test block for holding the wet Diastix as well as the knob turned to activate the indicator-buzzer. The company provides the following current product specifications:

> This instrument measures glucose levels in urine in conjunction with an Ames Diastix. Range: 0%-2%. Accuracy: Instrument only + 5%. Power: Batteries rechargeable—100 operations between charges. Size: 16cm x 10cm x 6cm. Temperature: Designed for operation in temperatures of 0 C—50 C. Features: Timer gives audible signal for drying Diastix; Results are communicated by buzzer code for the following values: 0%, 1/10%, 1/4%, 1/2%, 1%, 2%; an abort signal sounds if user delays in completing the test sufficiently to make test inaccurate; a special battery test function allows battery level to be checked prior to urine test. The Diastix holder can be removed from the device for washing.

Hypo-Test

Hypoguard Ltd.
Dock Lane, Melton
Woodbridge, Suffolk
England 1P12 1PE
Tel: Woodbridge (03943) 7333/4

A homemade urine-glucose analyzer with an audible code can be built from components purchased from an electrical supply store. One such device is described in the March 1977 issue of *Diabetes*, volume 26, pages 192-195; it is called the *Audio-Urine-Glucose Analyzer*. The authors of the article, who developed the machine, describe its construction and their testing of it. Provided as well are essentials for constructing and using the device: the circuit diagram, instructions for calibrating the device, instructions for operation. The authors estimate a cost of $150.00 (1977 prices) for materials and about 24 hours of work.

Yeast Method

An alternative method of urine-glucose analysis, which might be called tactual, is the yeast method. Though it can be messy, cumbersome, and time-consuming, the procedure is still used by some people. It is based on the fact that glucose reacts with yeast to produce a gas, carbon dioxide. A test tube containing the urine specimen (approximately 12 cc) receives 1/4 teaspoon of yeast; a finger cot is then placed over the test tube opening. After about 10 minutes, if glucose is present in the urine, the yeast reacts with it to produce carbon dioxide; the gas expands to inflate the finger cot covering the test tube. The relative tautness of the inflated finger cot can be felt to determine the approximate amount of glucose present—none, a moderate amount, a great deal. The information gained is only a rough indication. Yet even with its obvious limitations, the method may be appropriate for some people seeking independence in urine-glucose analysis with vision loss.

For all of the methods of urine-glucose analysis described, the advantages are to be weighed against limitations, and, of course, any selection of method must take into consideration the particular needs and capabilities of the person using the method—amount and kind vision loss, hand motor skills (though no extraordinary ones are needed), motivation. In addition, it should be remembered that there are limitations to the value of urine-glucose testing explained in the following article, "Home Blood Glucose Monitoring for the Visually Impaired Diabetic."

Home Blood Glucose Monitoring for the Visually Impaired Diabetic

by
Judith W. Oehler, R.N., Ed.D.

Home blood glucose monitoring is perhaps the most exciting innovation in the treatment of diabetes since the discovery of insulin. With a disease which must be patient-managed, it is inspiring that diabetologists have realized the importance of providing to the diabetic the opportunity to monitor blood glucose, a responsibility previously restricted to the physician.

As indicated by the title of Dr. Charles Peterson's book, *Take Charge of Your Diabetes*, home blood glucose monitoring enables the individual to take charge rather than to be controlled by the diabetes. In addition, "The assumption by patients of the responsibility for management of their own disease tends to break the pattern of nihilism and frustration often found in both patient and physician."[1] Finally, home blood glucose monitoring teaches even the veteran with diabetes new information regarding the effect of insulin, food and exercise upon the blood sugar.

Urine testing, the traditional method for monitoring diabetes self-care, provides only an indication of how high or low the blood sugar actually is. Normally, one's blood sugar should be between 70 and 140 milligrams per deciliter (mg/dl) of blood. Ninety mg/dl is the normal premeal blood sugar. Glucose or sugar normally spills into the urine (renal threshold) at 180 mg/dl. Consequently, a negative (blue) urine test with Clinitest indicates that the blood sugar is 180 mg/dl or lower, but not how low, and can reflect a blood sugar ranging anywhere from 0 to 180 mg/dl. A trace reading with Clinitest indicates that the blood sugar is at least as high as 180 mg/dl. A four plus (yellow or orange) Clinitest reading indicates that the blood sugar is high, but not how high. Blood sugar in this case can be 350 mg/dl or higher. Another problem with urine tests is that the renal threshold of long-term diabetics may be altered so that glucose may spill into the urine at a point above 180 mg/dl. In such cases urine tests appear lower than they actually are. In general, while urine testing provides one with a "hunch" as to what the blood sugar is, home blood glucose monitoring provides an exact reading.

The individual experiencing vision loss from advanced diabetic retinopathy may be frustrated with the inadequacies of urine testing, and yet may also be frustrated by the difficulty or inability to perform home blood glucose monitoring because of the visual impairment. Rather than approaching this situation helplessly, it is the opinion of this author that the individual must say to himself or herself, "If home blood glucose monitoring is important to me, I will find a way to have the test performed in spite of my visual impairment." It is also the opinion of this author that the easiest way to initiate a program of home blood glucose monitoring, is to begin by using the Chemstrip bG system manufactured by Biodynamics. Chemstrips do not require the use of a reflectance meter, or wash bottle and sink, they are extremely portable, and they are easy to read because the strip has two color reagent zones. Blood is placed on the reagent zone and wiped off with moderate pressure using cotton or tissue sixty seconds later. After waiting four minutes, the colors of the reagent zones are compared with color blocks ranging from 20 to 800 mg/dl which are on the Chemstrip bottle. Because of its simplicity, the low vision diabetic may be able to perform the Chemstrip test, but should there be difficulty matching the strip to the color blocks, it can be saved and read by another person later, as the strip remains stable. If the diabetic cannot perform the Chemstrip test, it is relatively easy for family, friends or readers to learn the procedure. The portability of the test permits it to be conducted in the office of a colleague, the home of a friend, or in any other location.

Chemstrips can usually be ordered through a local pharmacy. Each bottle contains 25 strips. The expense of the strips and the amount of blood needed to cover the two reagent zones on a strip can be reduced by cutting Chemstrips in half lengthwise. When cutting strips, it is important not to touch the reagent area, and when cutting is finished, strips should be placed immediately back in the bottle for storage.

Reflectance meters or home blood glucose monitoring machines are also available. The main advantage of these machines is that they read the strip directly so that visual inspection of color zones is not necessary. However, the main drawback of these machines is that they are expensive as well as somewhat more complicated to use. Both Ames Company and Biodynamics Company manufacture reflectance meters in the United States. The term reflectance meter refers to the amount of light reflected or absorbed by the reagent area which is dependent on the amount of glucose in the blood. With the STATTEK from Biodynamics, blood is placed on a STATTEK strip and wiped off after sixty seconds. After an additional sixty seconds, the strip is placed in the STATTEK machine which reads the amount of sugar on the strip in a manner similar to a scale. The meter provides readings from 50 to 350 mg/dl.

In 1970, Ames Company produced the EYETONE meter. This was the first reflectance meter available to measure blood glucose using a reagent strip. In the early 1980's, Ames developed the DEXTROMETER, a lighter machine than the EYETONE, which provided a digital read out of the blood sugar, and had the ability to be operated by a battery pack. The DEXTROMETER sells for $275. Soon after the DEXTROMETER was on the market, Ames developed the GLUCOMETER specifically for use by patients.

The GLUCOMETER which lists for $250 is lighter than the DEXTROMETER, is battery operated, has a digital read out, and in addition a built in timer which indicates when the strip should be washed off. With all Ames machines, the Dextrostix must be used, and the strips must be washed off with a stream of water at a specific time.

Studies have shown that the results of blood tests performed by diabetics in the home are as reliable as those performed in the laboratory. In addition, Chemstrips have been found to be as effective as tests performed by the reflectance meters.

Most people find the easiest method for obtaining a drop of blood from the finger is to use the Autolet manufactured by Ames, which takes the Monolet lancet manufactured by Monoject. The Autolet is a device into which a lancet is placed so that when a button on the device is pressed, the finger is automatically lanced or pricked. To obtain a drop of blood, the finger is swabbed with alcohol and wiped dry with a tissue or allowed to dry. (Alcohol distorts the test.) Before lancing the finger, if it is cold it may be warmed in water or massaged to get the blood flowing through it. Tissue juices squeezed out with the blood will not distort the results. The sides of the finger between the tip and first joint should be used rather than the pad of the finger where nerves are concentrated. Once the finger is pricked, a drop of blood should be "milked" out by dropping the finger below the heart, and slowly massaging it until a drop of blood forms. When a drop of blood has formed, the strip is brought to it, and the drop of blood is transferred from the finger to the strip. Smearing should be avoided, and the entire reagent area should be covered.

None of the home blood glucose monitoring systems have been adapted for use by the visually impaired diabetic. For the individual severely visually impaired from advanced diabetic retinopathy, the most difficult step would be transferring the drop of blood from the finger to the strip. However, if it were important to the individual, even this step could be mastered. Because it would be difficult to master this step, companies which manufacture reflectance meters have not invested money in adapting machines for the visually impaired. However, this author believes that the more phases which the visually impaired diabetic can control during the blood test, the easier it will be for him or her to become involved in home blood glucose monitoring. Therefore, it would be of benefit to the blind diabetic if the reflectance meters had auditory output. The more steps the visually impaired diabetic can control, the easier it is for him or her to instruct a sighted individual to assist with the remaining steps in the test.

Since use of Chemstrips bG is relatively easy to learn, the visually impaired diabetic may want to begin home blood glucose monitoring using this system. If the blind diabetic familiarizes himself or herself with this system, he or she may supervise a sighted person performing the test. Public Health and Visiting Nurses as well as representatives of Ames and Biodynamics can be helpful in instructing visually impaired diabetics and sighted blood testers in proper techniques. State and Chapter affiliates of the American Diabetes Association can be helpful in supplying information on local representatives of these companies, and on medical companies supplying test strips, Autolets, lancets and related equipment.

In general, persons who conduct home blood glucose monitoring have the advantage of knowing precisely what their blood sugar is, and of learning how specific amounts of food, insulin, and exercise affect their blood sugar. Another advantage is improved well-being and lessened depression. It is possible that maintaining normal blood sugar (euglycemia) can prevent or delay the onset or progression of eye, kidney and nerve complications. Many diabetics who embark on programs of home blood glucose monitoring, find that the condition of neuropathy improves. Episodes of hypoglycemia have been reported to decrease, and in one study, symptoms of hypoglycemia previously identified were actually found to be related to normal or high blood sugar. Another advantage of blood testing is that the blood pressure and pulse often decrease resulting in less strain on the heart. Finally, an important advantage is that diabetics who test their blood sugar involve themselves as partners in controlling their chronic disease, with their physicians acting as consultants.

The main disadvantage of blood glucose monitoring is the expense of the strips and reflectance meters, and the commitment of time. Time involved in blood testing decreases with familiarity. Initially, the need to lance the finger may seem like a drawback, but just as one becomes accustomed to insulin injections, one becomes accustomed to finger pricks.

Record keeping is extremely important so that one may act on the results of the blood test. Results may be documented by use of tape

recorder, or notebook when sighted persons assist with the test. The GLUCOMETER has a built in mechanism for recording test results. Initially, seven blood tests should be performed daily, before each meal, one hour after each meal, and before bed. For approximately two weeks the date, time of test, amount of insulin taken, exercise schedule, hypoglycemic episodes and other relevant information should be recorded. Records should be discussed with the physicians who will advise an appropriate alterations in the regime. Once euglycemia is attained, two to four blood tests daily are optimum.

Perhaps the most helpful book which has been published on the subject of home blood glucose monitoring is *Take Charge of Your Diabetes* by Charles M. Peterson, M.D. The book has been recorded by Recording for the Blind (215 East 58th Street, New York, New York 10022). An inkprint copy may be purchased for $3.95 form P.O. Box 9754, St. Paul, Minnesota 55197. It would be advisable to read this book before embarking on a home blood glucose monitoring program. In addition the July-August 1980 issue of *Diabetes Forecast* has an excellent article which discusses this subject.

It is extremely important that the visual impairment not interfere with testing urine or blood for glucose. The visual impairment may make it more difficult to initiate a program, but once a program is developed, the individual will find it becomes routine.

REFERENCES

1. Peterson, C.M., Forhan, S.E. and Jones, R.L. "Self-Management: An Approach to Patients With Insulin-Dependent Diabetes Mellitus." *Diabetes Care*, Vol. 3, No. 1, Jan.-Feb., 1980.

2. Birch, K., Hilldebrandt, P., Marshall, M.O. and Sestoft, L. "Self-Monitoring of Blood Glucose without a Meter." *Diabetes Care*, Vol. 4, No. 3, May-June, 1981.

3. Jovanovic, L. and Peterson, C.M. "Is Home Blood Glucose Monitoring For YOU?" *Diabetes Forecast*, Vol. 33, No. 4, July-Aug., 1980.

DIET AND EXERCISE MANAGEMENT

Diet

The effects of food and exercise on blood glucose levels have been and continue to be subjects of diabetes research. In respect to food, it is traditional clinical practice to prescribe a diet balanced in protein, fat, and carbohydrate and planned for calories as one component in glycemic control.

For many diabetics, a correlation between eating concentrated sweets and experiencing steep rises in blood glucose levels has been observed; thus, candy, pastry, and other foods saturated with simple sugar are eliminated from the orthodox diabetic diet. In addition, calories are controlled to fit exactly the person's energy requirements: calories are kept to the minimum to maintain ideal weight, since it has been observed that excess body fat can interfere with the cells' use of insulin; yet calories are also held at levels sufficient to balance the insulin dose, to prevent blood glucose levels from falling below normal.

In order to plan meals and prepare foods in accordance with this diet, information on food content is necessary along with recipes calculated for calories and for carbohydrate, protein, and fat in the prescribed balance. Exchange lists provide information on food content by dividing specific foods among basic categories such as milk, vegetable, fruit, bread, and meat. A measure of a specific food within a category will equal 1 Exchange—for example, 3 tablespoons of wheat germ equals 1 Bread Exchange. Exchange lists are used in conjunction with the diabetic diet, also called the diabetic meal plan, which details numbers and kinds of exchanges permitted each meal daily. Basic information on food composition is available in books on nutrition and in bulletins published by the U.S. Department of Agriculture. Exchange lists and meal plans are available from the American Diabetes Association, headquartered at 2 Park Avenue, New York, N.Y. 10016, with local affiliates across the country; diabetic clinics associated with large hospitals frequently prepare and provide their own exchange lists and meal plans tailored to the individual diabetic. Diabetic cookbooks provide recipes for dishes to fit the diabetic meal plan, and they are available, along with exchange lists and books on nutrition, in braille, on cassettes or disks, or in large print editions. A partial listing follows, and includes other cookbooks which are adaptable to the diabetic diet and available in nonvisual media or large print.

Resources

Breads: Guild Tested Recipes
Marie Porter, Editor
Chicago: The Guild for the Blind
50 recipes for wholesome yeast breads. (But recipes for quick breads contain much simple sugar.)

The Guild for the Blind	Braille
180 North Michigan	Cassette
Chicago, IL 60601	Large Print
(312) 236-8569	Price: $6.00

The Calculating Cook
by Jeanne Jones
San Francisco: 101 Productions, 1978
French sauces, Mexican dishes, curries, and other exotic food adapted for diabetic diet. Approved by the American Diabetes Association.

101 Productions	
834 Mission Street	
San Francisco, CA 94103	
or	
Charles Scribner's Sons	
Book Warehouse	
12 Breeland Avenue	Print
Totonia, NJ	Price: $5.95
and	
The Lighthouse for the Blind	
111 East 59th street	Braille
New York, NY 10022	Price: $34.00

A Cookbook for Diabetics
Pittsburgh: Forbes Health Systems, 1976
Recipes with exchange breakdowns; exchange breakdowns for commercial, processed foods.

Education Department	
Forbes Health Systems	Print
500 Finley Street	Price: $2.50
Pittsburgh, PA 15206	Postage: .50

American Printing House	
for the Blind	
1839 Frankfort Avenue	
P.O. Box 6085	
Louisville, KY 40206	Braille
(502) 895-2405	Price: $11.00

Cookbooks for People with Diabetes
Selected Annotations, Prepared by the
National Diabetes Information Clearinghouse, May 1981
Listing of 44 cookbooks published since 1976. Ordering information given.
National Diabetes Information Clearinghouse
805 15th Street, N.W., Suite 500
Washington, D.C. 20005 — Print
(202) 842-7630 — Price: Free

Craig Claiborne's Gourmet Diet
by Craig Claiborne and Pierre Franey
Haute cuisine: low salt, low fat, beefless recipes.
Print
Local bookstores, libraries — Price: $2.95/paperback
$10.95/hardcover

Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W. — Disk: Order No. RD 15781
Washington, D.C. 20542 — Cassette: Order No. RC 15781

The Diabetic Gourmet
by Angela Bowen, M.D.
New York: Harper and Row, 1970
Family meals, diabetic recipes, emphasis on unsaturated fats. Carbohydrate, protein, fat content for individual portion.
Print
Local bookstores, libraries — Price: $10.95

Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542 — Disk: Order No. TB 3733

Diabetic Menus, Meals, and Recipes
by Betty M. West
Garden city, New York: Doubleday and Company, Inc.
Recipes with breakdowns for calories, vitamins, minerals, exchanges.
Doubleday and Co., Inc.
501 Franklin Avenue
Garden City, NY 11530 — Print
(516) 294-4561 — Price: $7.95
and
G.K. Hall
70 Lincoln Street — Large Print
Boston, MA 02111 — Price: $12.95

The Diabetic's Total Health Book
by June Bierman and Barbara Toohey
Los Angeles: J.P. Tarcher, Inc., 1980
Balances various perspectives on diet provided by new trends in nutrition and insulin therapy; looks at exercise with diet and blood sugar control.
Sugarfree Center for Diabetics
5623 Matilija Avenue — Print
Van Nuys, CA 91401 — Price: $10.95
Also available at local bookstores, libraries.

Diet and Nutrition: A Holistic Approach
by Rudolph Ballentine, M.D.
Honesdale, Pennsylvania: The Himalayan
International Institute, 1979
Basic explanation of physiology of food intake, digestion, and metabolism, including body's use of complex carbohydrates (whole grains, legumes, etc.) in holistic context.
Himalayan International Institute — Print
Honesdale, PA — Price: $8.95

Regional Library for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500 — Cassette: Order No. RC 15777

Easy Cooking for One or Two
by Louise Davies
Written by specialist in geriatric nutrition. Emphasis on non-meat protein.
Mrs. Audrey Artus
ADA Reading Service
12 Renhold Road — Cassette
Wilden, Bedford — To order: send self-addressed stamped
England — envelope with 2 C60 cassettes.
Telephone: Bedford (0234) 771693 — Price: Free
and
Magna Print Books
Magna House
Long Preston, near Skipton
North Yorkshire BD23 4ND
England — Large Print
Telephone: Long Preston (07294) 225 — Price: L5.50

The Elegant Touch Cookbook: Gourmet Cooking for the Diabetic
by Marjorie Zats and Karen Rubin
Minneapolis: Jonathan David Company
Classic European cuisine adapted to diabetic diet: menu suggestions, caloric values, exchanges, cooking hints.
Jonathan David Company
540 Taft Street, N.E. — Large Print
Minneapolis, MN 55413 — Price: $9.45

Encore
compiled and recorded
by Library of Congress
A bimonthly "talking" magazine. Includes *Diabetes Forecast*, which contains articles on diabetes, recipes, resources, etc.
Regional Library for the Blind — Cassette available through
and Physically Handicapped — direct circulation.

Exchange Lists for Meal Planning
prepared by American Diabetes Association
Wide variety of common foods ranked in exchange lists according to food category and measure.
Volunteer Braille Services
P.O. Box 1592
Houma, LA 70361 — Cassette
(504) 872-9658 — Price: $5.00
and
Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500 — Cassette: Order No. RC 165

Look 'N Cook
by Ida Erickson
Willmar, Minnesota: Biword, 1980
Includes chapter of recipes for diabetics. Hearty favorites (spaghetti, stew, macaroni and cheese) with exchange breakdowns.

Biword Publications	Large Print
Box 20	Price $9.95
Willmar, MN 56201	Postage & Handling: 2.00

Exercise

The role of exercise in diabetes control is less certain than that of diet. Generally, in providing information on diabetes control, medical professionals state that exercise is desirable, and they point out its blood glucose-lowering effects in conjunction with insulin; they mention that exercise can play an important part in the treatment of diabetes (Joslin's *Diabetes Mellitus*, p. 291). But the effects of exercise on blood glucose level are not consistent. It has been observed that sudden bouts of rigorous exercise, especially when they interrupt a sedentary life style or a period of inadequate insulin, can actually raise blood sugar. Extremely vigorous, prolonged exercise, such as mountain climbing under the extra stress of high altitudes, has likewise been observed to raise rather than lower blood sugars even with insulin adequate according to calculations and even with carefully prepared physical fitness (Oehler, *Diabetes Forecast*, 34(6), Nov/Dec 1981). It would appear that medical research is needed to continue efforts to describe the effects of exercise on diabetes under varying conditions.

Yet moderate and consistent exercise has been observed to lower blood sugar levels, to improve circulation, and to reduce stress. Resources for exercise programs follow.

Resources

Be Alive as Long as You Live: The Older Person's Complete Guide to Exercise for Joyful Living
by Lawrence J. Frankel and Betty Byrd Richard, 1980
Gentle exercise to be performed from standing, sitting, and lying positions to improve circulation, tone muscles, increase flexibility, relieve tension and stress.
Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500 — Cassette: Order No.

The Diabetic's Sports and Exercise Book
by June Bierman and Barbara Toohey
New York: J.P. Lippencott Co., 1977
Effects of exercise on mind, body, insulin requirements, diet; exercise programs; coping with insulin reactions.

Sugarfree Center for Diabetics	
5623 Matilija Avenue	Print
Van Nuys, CA 91401	Price: $10.95

Also available in local bookstores, libraries.

Sports and Exercise for People with Diabetes
Selected Annotations, Prepared by the National Diabetes Information Clearinghouse, Jan. 1981
Annotated bibliography of print materials, educational films, and research studies on exercise and diabetes.

National Diabetes Information Clearinghouse	
805 15th Street, N.W., Suite 500	
Washington, D.C. 20005	Print
(202) 842-7630	Price: Free

Techniques for Foot Care by the Visually Impaired Diabetic

by
Allene R. VanSon, R.N.

A commonly experienced medical problem with diabetes is impairment of the healing process which can result in infection, especially in the extremities since blood circulation there tends to be more restricted. For the diabetic, then, foot care can become essential.

The material below is designed to encourage independence and self-management of compulsory foot care for the visually handicapped person with diabetes mellitus. The text addresses the consumer and aims to give step-by-step instructions in foot care.

Not only is your body changing because you are growing older; you have diabetes. Diabetes affects your blood vessels and nerve endings, including those in the feet and legs. Normally, blood travels through the arteries and veins carrying nourishment and oxygen to the cells and removes waste products. But in time these blood vessels can become narrow and plugged or hard and stiff, losing their ability to move blood easily. The resulting decreased circulation to the feet and legs can lead to a variety of complications. When nerve endings are affected by diabetes, pain can occur in feet and legs, especially at night. But actual sensitivity is decreased, which diminishes the ability to monitor heat, cold, and pain quickly; therefore, burns, frostbite, and injury can occur without awareness. Also there is a tendency for calluses and toenails to grow hard and thick, and these changes can lead to additional problems. Together these factors can produce ulcers and injuries that do not heal easily; further, gangrene can develop and result in amputation of toes, feet, or legs. Attention to foot care is an essential step in helping to prevent these serious complications.

Things You Can Do to Protect Your Feet

Control your blood sugar. Use meal plan, medication, and exercise designed to help keep blood sugar levels between 60 and 120 mg. fasting.

Wash feet daily unless skin is dry; then wash every other day. Check temperature of water by putting a drop on inside of wrist. If drop feels warm, but not hot, water is ready for use. *Do not* soak feet because soaking dries the tissues by washing out natural oils.

Use mild soap containing oil or lotion; Tone soap or Dermassage lotion are good choices.

Use a soft washcloth to rub off the dry skin gently.

Pat completely dry, especially between the toes.

Lubricate the skin at night with creams or lotions.

Check the condition of your feet daily. Gently run your hands all over your feet and legs. Note andy changes in the skin, e.g., dryness, callus formation, or injury.

Wear clean socks or stockings (hose) to protect your skin from the shoes. Hose with holes or mends may cause an injury.

Make certain that shoes fit comfortably and are in good condition. Remember that sandals and open-toed slippers do not protect your feet. Always use your hand to check the shoe for cracks, rough spots or objects before placing the shoe on your foot. Always "break in" new shoes by wearing them for one to two hours each day, for one to two weeks.

Take action if an injury occurs:

Small cuts: Stop the bleeding, wash with warm water, cover with dry sterile dressing. Seek help.

Blisters: Do not open the blister. Cover with a dry sterile dressing. Seek assistance.

Small burns: Immediately place burned area in cold water. Cover with a dry sterile dressing. Seek help.

Larger cuts and burns: Seek help.

Foot or leg ulcers: Give *special* attention. Follow *all* medical advice for soaking the area or applying medication and dressings. Enlist someone—a friend, relative, medical professional, etc.—to view the area daily.

Prevent burns! Use warm socks instead of hot water bottles, heating pads, or direct contact with radiator to warm feet.

Wear warm, dry boots to prevent frostbite in winter.

Keep toenails trim. File with an emery board; follow the curve of the toe. First soak feet in warm water for five to seven minutes to soften the nails before filing.

Things Someone Else Must Do to Protect Your Feet

A podiatrist or family member can file, clip, or cut your toenails following the curve of the toe. You can reduce the number of times you need help by using the emery board weekly.

Your feet and legs must be viewed at least once each week; a more frequent inspection is desirable.

Corns and calluses must be removed by a podiatrist.

Injuries require medical assistance.

Things to Do to Improve the Circulation in Your Feet and Legs

Develop a daily walking program with your doctor's permission.

Increase the distance and the rate of walking gradually. Use the heel-toe method of walking.

Do not sit still for long periods of time. Move about frequently. Wiggle your feet and toes while sitting.

Do not cross your legs.

Do not wear constricting garments or garters. They restrict the blood flow.

Nicotine slows the blood flow to your feet and legs; therefore, you are encouraged not to smoke.

It is your responsibility to take care of your feet and legs and to seek help when you need it, before a problem develops.

Resource

Time Out for Foot Care (anon)
Minneapolis: Metropolitan Medical Center, 1977
This is an illustrated outline of the Buerger-Allen exercises designed to increase foot comfort and improve blood flow to and from the feet. Eight guidelines to good foot care are also given.
Diabetes Education
Metropolitan Medical Center
900 South Eighth Street
Minneapolis, MN 55404
(612) 347-4654 Price: $0.25; $2.50/12

The Role of the Rehabilitation Center in Serving the Diabetic Person

by
Laura Marletta, M.Ed.

Not addressing the issue of diabetic control with the visually impaired diabetic in a rehabilitation setting is overlooking a major component of that person's rehabilitation program. If the diabetic client is not under the best possible control, that individual will not be able to work to the best of his/her ability. Participation in a rehabilitation program requires a great deal of physical stamina and mental alertness. The person with diabetes cannot afford to be feeling "sick."

Actually, control of the disease should be sought before the person is sent to a rehabilitation center. This effort could be coordinated by the rehabilitation counselor. A complete physical examination is part of the vocational rehabilitation process. The counselor could request specific information and recommendations from the physician on diabetes control. "Is the individual motivated toward good control?" Most large hospitals offer diabetes training programs. If the prospective client has not attended such a program, or it has been a number of years since attendance, the counselor should request the client attend a program as part of the total rehabilitation program.

Diabetic clients are not always unwilling to attend classes on diabetes; however, transportation and participation in the classes can be problems for the visually impaired person. The counselor should assume responsibility for alleviating these problems. Some people may get defensive when asked to attend such a class and state they know everything there is to know about diabetes. "After all, I have lived with it all my life!" However, if the onset of diabetes was during childhood, much information was perhaps learned indirectly at home twenty odd years ago. Much information has changed since then and is constantly changing as new developments are made.

In the past, much of the more technical information was withheld from the patient for fear of overburdening or frightening him. I believe ignorance of one's disease is what causes fear. Accurate information can provide the individual with the freedom to control his/her disease—preventing the disease from controlling the person.

A good time to review what is known about diabetes control is when the visually impaired diabetic enters the rehabilitation center. This can be done by anyone on the rehabilitation team possessing up-to-date, accurate knowledge about diabetes. Questions can be asked informally. For example: "What caloried diet are you on?" "How many exchanges are you allowed at each meal?" "How do you adjust for high urine/blood glucose tests?," etc. A more formal questionnaire can be devised to pinpoint areas where more knowledge is needed, or any problems the individual might be having with control.

Diabetics enrolled in a center program should be requested to wear identification stating they are diabetic. Medic Alert is an excellent form of identification. Also, as a remedy for possible unconsciousness due to hypoglycemia—low blood sugar or insulin shock—the diabetic should carry some form of quick sugar at all times. These two precautions protect both the client and the center. Diabetics should be encouraged to continue these practices at home.

Blood glucose/urine testing is essential for the diabetic. This is where a staff nurse would be helpful to perform this test before each meal and at bedtime. For some diabetics this might be the first time blood glucose has been checked regularly, and this would give them an idea of what type of control they are maintaining. Additionally, for those diabetics who are regularly checked at home, this service should be continued while at the rehabilitation center. Some professionals feel we are imposing our values on diabetic clients when we demand that urine/blood glucose be checked. I do not view this procedure as imposing values, but providing an environment for maintaining good health. Would a visually impaired person be

allowed to travel outdoors without a cane while at the Center? The health risk is the same.

A diabetic who is not monitoring blood sugar/urine sugar levels has no idea what kind of control is being maintained. With the change in activity level while at the Center, insulin amount/diet may have to be altered. The only way to know how much is by testing. Many diabetics say to me "I know how my blood sugars are running by the way I feel." By the time the person starts to feel the effects of elevated blood sugar, the sugar level has been high for a while. Once blood sugar is elevated, it is much harder to bring it down. More importantly, the person runs the risk of going into acidosis (dehydration) and if untreated, diabetic coma, which is a life-threatening condition. On the other hand, running a consistently low blood sugar can impair judgment and impede the learning process.

An area where rehabilitation centers can really fall down in accommodating the diabetic is diet. The food that is often served in these institutions is not conducive to the diabetic diet and overall good control. Typically, the food is high in starch and sugar and low in fresh vegetable and fruit, lean protein sources and complex carbohydrate. A meal I was served at one such institution consisted of a large plate of spaghetti with meat sauce (very little meat and the sauce tasted sweet), garlic bread, a small salad, and cake. The meal was mostly starchy carbohydrate. A diabetic eating that meal would probably leave the table with an extremely elevated blood sugar. Rehabilitation centers must start serving more nutritious meals, which would be better for everyone. A diet rich in fresh or frozen vegetables (plain), complex carbohydrate such as whole grains and legumes, lean meats and fish and fruit is much better.

The rehabilitation teacher plays an important role in teaching the diabetic client good nutrition. Once a diet has been prescribed, the R.T. can review it with the client and go over what is included in the different exchange lists. The diet should be put in a form that is easily read by the client. Eventually the person should have the diet memorized. Reviewing portion sizes with tactile models is very helpful. For example, a three-ounce piece of chicken is about this big. The principles of preparing meals from scratch as opposed to relying on prepared foods is essential for the diabetic to maintain good control. (Many prepared/packaged foods contain high levels of sugar and salt.)

The R.T. also teaches the use of insulin measuring devices. This should be done in conjunction with a nurse to be sure the proper procedure is used. In my work as an itinerant rehabilitation teacher, I have observed many people, diabetics of long duration, incorrectly drawing up the insulin dose, particularly with a mixed dose.

In summary, if the rehabilitation center is addressing the areas of mobility, communications, personal hygiene, housekeeping, etc., is not management of health just as important? Actually, control of diabetes is necessary before anything else can be learned. The issue of striving for good control of diabetes is still debated by many physicians, so the confusion many diabetics have about their diabetes is understandable. However, more and more of the literature on diabetes points to the benefits of maintaining near normal blood glucose levels. People coming to the rehabilitation center have lost their eyesight; possibly, addressing the issue of good control can prevent further complications and prolong a more productive life.

Further Resources for Rehabilitation Teachers

Diabetes Teaching Guide
by George P. Kozak, M.D.
Boston: Joslin Diabetes Foundation, 1977.
Instructions for urine sugar testing, the diabetic diet, insulin use and administration techniques, symptoms of and remedies for hyperglycemia (high blood sugar) and hypoglycemia (low blood sugar), managing insulin and diet on sick days, etc. A revised edition planned for Fall 1982 will discuss home blood glucose monitoring. The text is written for newly diagnosed or recently hospitalized diabetics.
The Joslin Clinic
One Joslin Place
Boston, MA 02215 — Print.
(617) 732-2539 — Price: $4.00

Joslin Diabetes Manual, 11th Edition
Edited by L.P. Krall
Philadelphia: Lea and Febiger, 1978.
Information on diabetes including illustrations, charts, photographs.
Lea and Febiger
600 South Washington Square
Philadelphia, PA 19106
(215) 922-1330
and
The Joslin Clinic — Print.
One Joslin Place — Price: $8.50 (English)
Boston, MA 02215 — $13.50 (Spanish)
or
G.K. Hall
70 Lincoln Street — Large Print.
Boston, MA 02111 — Price: $24.75 (2 volumes)

Materials and Aids for the Visually Impaired Diabetic
Prepared by the National Diabetes Information Clearinghouse
July 1980
A bibliography of information on diabetes-related visual impairment, it lists 114 items in various media and includes devices with price and ordering information.
National Diabetes Information Clearinghouse
Box NDIC
Bethesda, MD 20205
(301) 496-7433 — Print.
(202) 842-7630 — Price: Free.

Special Devices and Equipment for the Visually Impaired Diabetic
Prepared by R. Keith Campbell
American Pharmacy
Washington, D.C.: American Pharmaceutical Association, 1981.
It evaluates some urine testing systems and magnifiers (as well as such technologically advanced aids as the Optacon).
Vision Foundation, Inc.
770 Centre Street
Newton, MA 02150
1-800-852-3029 — Cassette.
1-617-965-5877 — Price: $2.00

Teaching Guides for Diabetes Education Programs: Selected Annotations
Prepared by National Diabetes Information Clearinghouse
June 1979
A bibliography of materials which are instructional vs. simply informational, useful to health professionals in designing programs, or useful to patients and families as a study guide.
National Diabetes Information Clearinghouse
Box NDIC
Bethesda, MD 20205
(301) 496-7433 — Print.
(202) 842-7630 — Price: Free.

You, Your Eyes and Your Diabetes
by Donna L. Johnson
Winnetka, Illinois: The Hadley School for the Blind, 1981.
Written for the diabetic who is experiencing vision loss, the book provides information about the condition, diet, exercise, insulin management, and preventive medicine in diabetic control.
The Hadley School for the Blind — Jumbo Braille.
700 Elm Street — Large Print.
Winnetka, Illinois 60093 — Cassette.
1-800-323-4238 — Borrowed as part of
1-800-942-4193 (Illinois residents) — correspondence course.

Views of a Blind Diabetic

by

Davide Marletta, M.Ed.

I have been a diabetic for the last 27 years, legally blind, eight, and totally blind, three of the last eight. Much to the amazement of sighted, nondiabetics, I often think and say that I would rather be blind than diabetic. I guess the main reason for this attitude on my part is that I know what to expect from my blindness and have many aids and appliances to choose from to help me perform activities in both my personal and professional life. However, there seems to be much that still has to be learned about diabetes; the future, although promising, is still not definite. More and more of the literature these days seems to indicate that proper control of diabetes either prevents or minimizes complications. However, there still seems to be some disagreement over just what good control entails. Attitudes sometimes seem to change so fast that it is often difficult to stay on top of things. I can recall many years ago that I was instructed to spill sugar in the urine before going to bed in order to avoid insulin reactions during the night. Today, the emphasis is to stay as much within the normal range of blood glucose as possible. Although I am trying to do this, and have felt better for it, I still come across other diabetics and health and rehabilitation professionals who maintain that it is not possible for an insulin dependent diabetic to achieve near normal blood glucose levels or that reactions are to be avoided. Personally, I think that reactions once in a while are not bad; it indicates to me that my body is making full use of all the food that I am eating. (Of course, if reactions persist, then I must make some adjustments in either insulin or diet.)

Since what we know about diabetes today is more than we knew years ago, I cannot take all the blame for my diabetic retinopathy. However, I must admit that there was a good amount of cheating on my part. I think I was trying not to have my diabetes run my life; unfortunately, this took place through totally denying its existence rather than attempting to maintain proper control. Even after going through four months at a rehabilitation center, and learning how to use devices for measuring insulin myself, I blamed the diabetes for everything. At one point I actually believed that while I needed insulin to live, its constant use was also killing me; I thought that I had about five years left to live. With an attitude like that, it is no wonder that I continued to cheat knowingly.

It was at this point that I met two great women. One was the woman I would eventually marry; the other was the diabetic teaching nurse at the local medical center. I remember my girlfriend saying that she was glad to help me with my diabetes, but that it was my condition and I would have to accept some responsibility for it. Then, through the nurse, I learned that I was not dying and could live a good life if I would just take care of myself. The prospect of perhaps losing the woman I loved was the incentive I needed to try and get my act together. Although I thought none of this control business would work, I decided to give it a try. Surprise of surprises—I felt better, got good reports from my doctor, had better dental checkups. I began to get control of my actions and therefore my life. Today, I am happily married, successfully employed, get good medical checkups, and, in the last year, have become a father for the first time.

I am still striving for that sometimes unreachable goal: always having a blood glucose of sixty to one hundred twenty. However, in striving for it, I feel well, remain healthy and, surprisingly enough, find I have more freedom. That is, by knowing my diet, the exchanges, and how my insulin works, I find that I can make the necessary adjustments in an effort to maintain optimum control.

Admittedly, I do find that my diabetes is pretty constant on my mind. Now that I take three shots a day, I find I am very conscious of the time, so that I might take my shot at the proper time. When I eat out, I constantly am trying to figure out all the exchanges for that meal; sometimes this means not always eating exactly what I want. How nice it would be to go to a restaurant sometime and just pig out!

And, unfortunately, the issue of blindness and diabetes is not always so positive. To be honest, blindness itself is negative, even though with a lot of effort and support, it can be used in a positive manner. In my mind, diabetes is *never* positive. I see it as a potentially destructive disease. While more evidence points to good control being the key, who can say what the findings will be ten or twenty years from now? As if being diabetic was not enough, being blind on top of it makes it virtually impossible to be completely independent. At present, there are no devices available allowing me to draw my own syringes since I use low dose syringes; I have found no way that I can monitor either urine or blood sugars myself. For these things, I absolutely have to depend upon sighted help; fortunately, my wife is willing to do this for me. The idea that continuing to have elevated blood sugars might lead to even more complications is very frightening, to say the least. Because adolescence is hard enough, I dread the possibility of our son becoming a diabetic and having to deal with growing up in that context.

But, most significantly, I continue to be mostly optimistic that I can obtain good control and maintain it for the rest of my life; in the meantime, I feel great and just wish that they would hurry up and cure diabetes.

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DIABETIC CONTROL:
EQUIPMENT FOR USE WITH
VISION LOSS.
(1982)

Date Due

Reference	Copy		